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# PROCEEDINGS

OF THE

## ROYAL GEOGRAPHICAL SOCIETY.



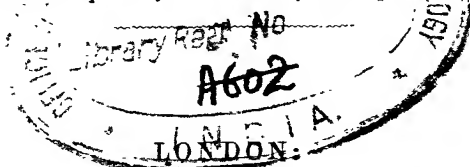
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VOL. XXI.  
SESSION 1876-77.

Nos. I. to VI.

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1, SAVILE ROW, W.  
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Vol. 1. No. 1. 1891. ....

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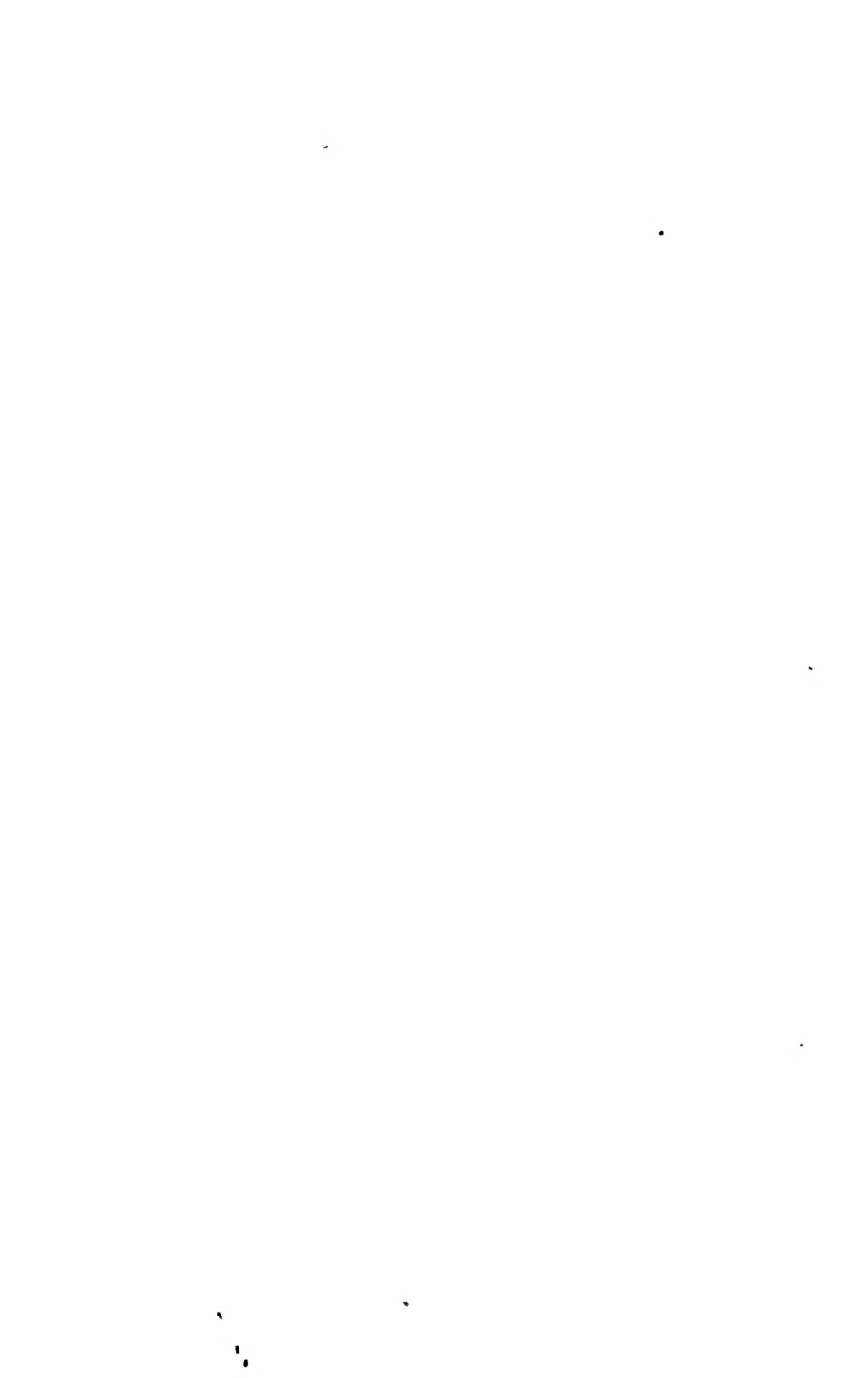
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# PROCEEDINGS

## OF

# THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED JANUARY 19TH, 1877.]

SESSION 1876-7.

*First Meeting, 13th November, 1876.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*O. C. Stone, Esq.*; *Rev. John P. Hobson, M.A.*

ELECTIONS.—*Peter George Laurie, Esq.*; *L. Rosenthal, Esq.*

DONATIONS TO LIBRARY, 26TH JUNE TO 13TH NOVEMBER, 1876.—  
Memoirs of the Geological Survey of India, Ser. ix., 4, Cephalopoda, by W. Waagen; xi. pt. 2; Records. ix. pt. 1 (*Dr. Oldham, Superint. of Survey*). The Encyclopædia Britannica, 9th ed., vols. i.—iv. (*Messrs. Black*). MSS. Private Journals of W. H. Hooper, Voyages of the Isabella and Alexander, Hecla and Griper, and Hecla and Fury, in search of a North-west Passage, 6 vols., 1818—1825 (*W. E. P. Hooper, Esq.*). Viaggio intorno al Globo della R. Pirocorvetta Italiana Magenta, di E. H. Giglioli; Milano, 1875 (*Author*). Account of primitive tribes and monuments of the Nilagiris, by J. W. Brecks, 1873: Report of a Mission to Yarkund in 1873, under command of Sir T. D. Forsyth, Calcutta, 1875; and Statistical account of Bengal, by W. W. Hunter (5 vols.), 1875 (*H.M. Secretary of State for India*). The Crimea and Transcaucasia, by J. Buchan Telfer, 1876 (*Author*). Journey in the Caucasus, by Max von Thielmann, translated by C. Heneage, 1875 (*Charles Heneage, Esq.*). Physikalische Beschreibung der Argentinischen Republik, vol. i., Buenos Aires, 1875, por H. Burmeister, and Translation in French by E. Maupas, Paris, 1876; also Caballos fosiles de la Pampa Argentina, Buenos Aires, 1875 (*Dr. H. Burmeister*). Notes of a Journey in Russian Turkistan, &c., by L.



Schuyler, 1876 (*Messrs. Sampson Low & Co.*). The Lucknow Album; Calcutta, 1874 (*E. Bickers, Esq.*). Handbook for South Africa, 2nd. ed., 1876 (*S. W. Silver, Esq.*). Handbook for Spain, 4th ed.; 1869, and Between the Danube and Black Sea, by H. C. Barkley, 1876 (*J. Murray, Esq.*). Virginia, a geographical and political Summary; Richmond, Va., 1876 (*H. N. Courtney, Esq.*). Parliamentary Reports on Arctic Expedition, Telegraphic Weather Intelligence, British Islands, 1875, Colony of Assunguy, Boundary between Canada and the United States, Islands of the Southern Ocean, New Guinea, Malay Peninsula and Straits Settlements, Trade between British Burmah and Western China, Expedition to Nan-Chang-Foo, Treaty between Japan and Corea, the murder of Mr. Margary, Affairs of the Gambia, West African Possessions, and Delagoa Bay (*Lord Arthur Russell, M.P.*). Observations on Ozone, by H. A. Cutting; Vermont, U.S.A., 1874 (*Author*). Subsidies to the formation of the physical Map of Brazil, by Homem de Mello; Rio de Janeiro, 1876 (*Author*). Registrande der geogr.-statistischen Abtheilung des Grossen Generalstabes, vi., for 1875 (*The Prussian General-Staff*). Astronomical and Meteorological observations in 1873, U. S. Naval Observatory; Washington, 1875 (*Lieut. G. M. Wheeler*). Meteorological tables and observations near the Victoria Nyanza, by E. Linant de Bellefonds, 1875 (*General Stone*). Zur Kartographie der europäischen Türkei, and Zur ethnographischen Karte des europäischen Orients, von H. Kiepert; Berlin, 1876 (*Author*). Reports of foreign Societies on awarding medals to American Arctic explorers; Washington, 1876 (*Prof. Nourse*). Notes on Geology of N.E. New Mexico, by O. St. John; Washington, 1876 (*Author*). Livingstone, Poème par G. Vallat; Moulins, 1876 (*Author*). Appalachia, organ of Mountain Club, Boston, 1876, vol. i., No. 1 (*The Club*). Archivos do Museu Nacional do Rio de Janeiro, vol. i., 1st trimestre, 1876 (*C. F. Hartt, Esq.*). Geographia fisica de Chile, por A. Pissis, text and atlas; Paris, 1875 (*H. E. Don Alberto Blest Gana, Chilean Minister, per T. K. Weir, Esq., Chilean Consul*). K. Svenska Fregatten Eugénies Resa, Häft. 13 & 14 (*The R. Academy of Sciences at Stockholm*). Results of Meteorological Observations, Vizagapatam, by A. V. Nursingrow; Calcutta, 1876 (*Author*). Tables of Temperatures of the Sea, reduced from observations during 1749—1868, by J. Prestwich, 1875 (*Author*). Botanical Reminiscences in British Guiana, by R. Schomburgk; Adelaide, 1876 (*Author*). A self-instructor in Navigation, 1876, and Lunars and Lunar tables, 1875, by W. H. Rosser (*I. Imray, Esq.*). The Cruise of the Freak, by Canon Brownrigg; Launceston, Tasmania, 1876 (*S. S. Crispo, Esq.*,

*Admiralty Survey, Melbourne*). On the general causes of Ocean-currents, Upsala, 1876, and Description of Instruments exhibited at Philadelphia, Stockholm, 1876, by F. L. Ekman (*Author*). Genève et le Mont Blanc, par A. Delaire; Paris, 1876 (*Author*). Carrara Marbles, by G. A. Lebour, 1876 (*Author*), Central-Afrika, von J. Chavanne; Wien, 1876 (*Author*). Journal of a tour through the Panjab, Afghanistan, &c., with Lieut. Burnes, by Munshi Mohan L'al, Calcutta, 1834; and Notice biographique sur J. Balmat, par M. Carrier, Genève, 1854 (*S. M. Drach, Esq.*). Canal interocéanique à travers le territoire du Darien; Paris, 1876 (*General E. Türr*). De l'Industrie agricole de Luxembourg, par E. Reuter; Luxembourg, 1875 (*Author*). Catalogo ragionato delle piu rare opere geografiche del Collegio Romano, da C. Castellani; Roma, 1876 (*Author*). Eine geologische Reise in den westlichen Balkan, von F. Toula; Wien, 1876 (*Author*). The Antananarivo Annual and Madagascar Magazine, No. 1, 1875 (*W. Johnson, Esq.*). Report by the Rev. R. Price of visit to Zanzibar, 1876 (*Rev. J. Mullens*). On changes in the tidal portions of the Mersey, by J. N. Shoolbred, 1876 (*Author*). Photograph of Captain J. Ross (*M. Feuillet de Conche, per M. Chas. Maunoir*). Life on the Nile, by W. W. Warren; Paris, 1867 (*Librarian*). Recherches sur le mouvement de la population de Genève, 1845—1872, par P. L. Dunant; Genève, 1876 (*Author*). Exploracion mineral en el Estado del Magdalena, Colombia; Cartajena, 1876 (*Archibald Peel, Esq.*). Calendario Azteca, por A. Chavero; Mexico, 1876 (*Author*). Report on the newly opened ports of Kiung Chow and Hai-Phong, by N. B. Dennys; Hong Kong, 1876 (*Author*). On the weather of 13 years at London, by R. Strachan, 1876 (*Author*). On the Mineral Resources of India, by W. T. Blanford, 1873 (*Prof. J. Tennant*). Exploration du Sahara central, Avenir de La France en Afrique, par P. Soleillet; Paris, 1875 (*Author*). Rates of Chronometers on trial, 1876; Arctic Expedition, Report of Proceedings, 1876; and H.M.S. Challenger, Report No. 6, on Soundings, &c., Pacific Ocean, 1875 (*The Lords Commissioners of the Admiralty*). Memorandum descriptive of the route between Sohar and El Bereymee in Oman, by E. C. Ross, 1876 (*H.M. Secretary of State for India*). The Franco-German War, 1st part, Sect. ix.; The armed strength of the German Empire, Part i.; and The armed strength of the Netherlands; by F. C. H. Clarke (*H.M. Secretary of State for War*). Publications of the Dépôt des Cartes et Plans de la Marine, Nos. 537, 546, 548—557 (*The French Admiralty*). Contribution to the Meteorology of Japan, by T. H. Tizard, 1876; Report of the Meteorological Committee of the Royal Society for 1875; and Results of

Monthly Observations, 1869—1875 (*The Meteorological Committee*). South Kensington Museum, Handbook and Catalogue, Special loan collection of Scientific Apparatus, 1876: Reports of Committee of Council on Education, England and Wales, and Scotland, 1875-6, and 3rd Annual Report of Board of Education for Scotland, 1876 (*Committee of Council on Education*). Journal of Mr. Lewis's Lake Eyre Expedition, 1874-5 (*H.M. Secretary of State for the Colonies*). Victoria: Statistical Register for 1875, parts 1, 2, 3, 4: Indexes for 1873, Patents, by R. Gibbs, 1875: Report of Chief Inspector of Mines for 1875; Mineral statistics for 1875; and Reports of Mining surveyors, 30th June, 1876 (*The Victorian Government*). Geological Survey of Victoria. Report of progress by R. Brough Smyth, with Reports on Geology, Mineralogy, and Physical structure by F. M. Krausé, and others; Melbourne, 1876 (*The Victorian Survey*). Statistics of New Zealand for 1875 (*The Registrar General of New Zealand*). Results of Meteorological observations made in N. S. Wales during 1874 (*The New South Wales Government*). Report of U. S. Geological Survey of the Territories, vol. ix. (Invertebrate Fossils of the Upper Missouri, by F. B. Meek), and x. (Phalænidæ of United States, by A. S. Packard); Washington, 1876 (*Dr. F. V. Hayden*). U.S. Geological Exploration of the 40th parallel. vol. v., Botany, by S. Watson and others; Washington, 1871 (*Clarence King, Geologist in charge*). Annual Report on geographical Explorations west of 100th meridian, California, &c., by G. M. Wheeler, and Report upon Geographical and Geological explorations and Surveys, &c., vol. iii., Geology; Washington, 1875 (*Lieut. G. M. Wheeler*). Botany, vol. i., uniform with publications of the Geological Survey of California; Cambridge, U.S.A., 1876 (*J. D. Whitney, State Geologist*). Reports of Superintendent of the U.S. Coast Survey, showing the progress in 1869, 1870, 1871, 1872, and 1873 (*C. P. Patterson, Superint. of the Survey*). Geological Survey of Canada, Report of progress in 1874-75 (*The Director of Survey, on behalf of Government of the Dominion*). Buletinul Societatii Geografice Romane, vol. i., Nos. 1-8; Bucharest, 1876 (*The Society*). Boletin de la Sociedad Geográfica de Madrid, vol. i., No. 1; Madrid, 1876 (*The Society*). Bulletin trimestriel de la Société Khédivale de Géographie du Caire, Nos. 1 and 2; Le Caire, 1876 (*The Society*). Also Transactions of the Royal Society of Edinburgh, xv., pt. 1; Proceedings of the Boston Society of Natural History, various sheets of vols. xi. and xiii., and Memoirs, vol. ii. 7 parts; K. Svenska Vet. Akad. Handlingar, xi., 1872; R. Instituto Lombardo, Memorie, x., fasc. i.-iv.; Bulletin de la Société de Géographie, 1ère série, vols. xix. and xx.,

and Table des Matières, 1844 à 1861 ; given by the various Societies, &c., mentioned, in or towards completion of series ; the continuation of Reclus's Géographie Universelle, vol. ii., by the Author ; and the current issue during the above period of publications of various corresponding Societies, and of Periodicals.

DONATIONS TO THE MAP-ROOM FROM JUNE 26TH TO NOVEMBER 13TH., 1876.—162 sheets of the Government Surveys of India (*H.M. Secretary of State for India, through the India Office*). 24 sheets of Admiralty Charts (*Hydrographic Office*). 38 sheets of French Charts (*Dépôt de la Marine*). 19 sheets of Ordnance Survey of Great Britain, Parish maps  $\frac{1}{25000}$  *H.M. First Commissioner of Works, through Major-General Cameron*). Map of Albert Nyanza, by M. Gessi ; Map of the Nile between Duffi and the Albert Nyanza, by M. Gessi ; Map of the Nile between Duffi and Magungo, by S. E. Gen. Gordon-Pacha ; Map of the Victoria Nile between Shoa Morou and Foweira, by S. E. Gen. Gordon-Pacha ; Map of the Victoria Nile between Foweira and Mrooli, by S. E. Gen. Gordon-Pacha ; Plan of Town of El Obeyad, by Commandant Prout (*Gen. Stone, Chief of the General Staff, Cairo*). MS. map of Albert Nyanza, by Rom. Gessi : MS. map of the Nile between Duffi and the Albert Nyanza, by Rom. Gessi (*Author*). Part XV. of the Geological Survey of Sweden, 3 sheets (*Otto Torell, Director*). MS. map of the Valleys of the Tibagy and Ivahy, Brazil (*T. P. Bigg-Wither, Esq.*). Map of the Sandjak Filibe (Philippopolis), European Turkey, by H. Kiepert 1876 (*Author*). Map of California and Nevada, 2 sheets ; Topographical map of Central California, &c., 4 sheets ; Region adjacent to Bay of San Francisco, 2 sheets ; Part of the Sierra Nevada adjacent to the Yosemite Valley ; Map of Yosemite Valley (*J. D. Whitney, Esq.*). Map to illustrate the History of Peru previous to 1553, by A. Raimondi, 1875 (*Author, through C. R. Markham, Esq.*). Parts VII., VIII., IX., of the Topographical Atlas of Switzerland,  $\frac{1}{25000}$  and  $\frac{1}{30000}$ , 36 sheets (*Col. Siegfried, Director*). Physical map of Brazil, by F. J. M. Homem de Mello, 1875 ; Illustration of the Comparative Altitudes of the Culminating points of Brazil, with a key plan, by F. J. M. Homem de Mello (*Author*). Map of the Province of Kwei-Chow, in Chinese characters (*W. Mesny, Esq.*). Geological map of Newfoundland, by Alex. Murray (*Author*). Map of Nova Zemlia and North coast of Russia, with MS. track of steam-ship "Ymer," 1876 (*Prof. Nordenskiöld*). Geological map of Scotland, by Arch. Geikie (*W. & A. K. Johnston*). Flags of All Nations (*Jas. Reynolds, Esq.*). 4 charts of the North Atlantic Ocean, showing the

direction and force of the Wind, by L. Brault, French Navy, 1874 (*Author, through J. F. Imray, Esq.*).

As soon as the Chair was taken, Mr. H. M. HYNDMAN rose to move a Resolution of which he had given notice.

The PRESIDENT said Mr. Hyndman was quite out of order.

The formal business of the Meeting was then proceeded with.

The PRESIDENT then stated that he had to bring before the Fellows a question which had been raised by one of their members, who had given notice to the Council some days previously that he would move a Resolution on that evening; the notice had been carefully considered that day by the Council, and a Minute was agreed to, which he would call upon the Secretary to read.

The SECRETARY (Mr. C. R. Markham) read the following Minute:—

*Minute of Council, Nov. 13, 1876.*

“A letter of the 23rd October from Mr. H. M. Hyndman having been read, giving notice of his intention to move at the Evening Meeting of the 13th November, a Resolution involving a vote of censure by the Council and Fellows of the Society of Mr. H. M. Stanley's method of dealing with the natives of Central Africa,—it was resolved unanimously that the Council considered it contrary to the Rules regulating the order of proceedings at the Ordinary Evening Meetings (chap. v., section 3, par. 4, 5) for any Fellow of the Society to bring forward a Resolution on any matter foreign to the proper business of the Meeting.”

Mr. HYNDMAN again rose and asked to be permitted to say a few words with reference to the opening Address of their illustrious President, Sir Henry Rawlinson, on the 15th November, 1875.

The PRESIDENT said that after the Minute of the Council they had just heard read he could not listen to anything which might lead to a discussion on a matter perfectly irrelevant to the proceedings of the Meeting as they had been arranged. Such was the Rule of the Society. The Council, however, would be sorry to be supposed to be desirous of suppressing any expression of opinion on the part of any of the Fellows; and if Mr. Hyndman and six other Fellows (the number required by the Regulations) would sign a requisition to the Council to call a Special Meeting to consider the amendment of the Rule prohibiting these motions, and if the Special Meeting agreed that the Rule was not a good one, though it had been in force for twenty or thirty years, of course some other Rule might be substituted; but as long as the present Rules existed the Chairman must enforce them.

The PRESIDENT, in opening the Session, addressed the Meeting as follows:—

THE duty of opening this, the Forty-seventh Session, of the Royal Geographical Society, which has devolved upon me by my election as your President at the last Anniversary Meeting, cannot fail to be a source of gratification to whoever you may thus honour with your confidence. I could have wished, indeed, that your choice had fallen on one more distinguished in Geographical Science, or by explorations of importance in unknown lands—of which class you number many, both in your Council

and among the Fellows of the Society at large. But when I glance over the list of Presidents from Sir Roderick Murchison, who may justly be considered the chief Founder of the Society, down to those who have more recently filled this Chair—Sir Bartle Frere and Sir Henry Rawlinson, more especially, who, though still actively engaged in the public service, have by their energy and personal influence greatly contributed to the prosperity and reputation of the Society—I may be well satisfied if I can emulate to any extent the earnest and generous spirit in which they have laboured as your Presidents, for the increased usefulness of this associated body of Geographers.

We are again indebted to the Senate of the University of London, as in so many previous years, for the permission to hold our meetings in this hall. The liberality of that enlightened body, and their continued kindness in allowing us, year after year, the use of this commodious theatre, is I am sure fully appreciated by the Fellows of the Geographical Society. It is not in our power to make any return beyond this public acknowledgment of the great service rendered, not to this Society only, I venture to think, but to the cause of Geographical Science and Discovery, and also to the public, by making the knowledge acquired more accessible.

Our steadily increasing numbers, with corresponding increase of income, may be taken as sufficient evidence of popular interest in our work, as well as the repute in which the Society is held, and both form a legitimate subject of congratulation on the opening of another Session. But these advantages, as my predecessor (Sir Henry Rawlinson) intimated in his closing address, are not without their drawbacks. In the ordinary business of these meetings, this handsome and commodious hall affords ample accommodation, and is, indeed, all we could desire. It is otherwise, however, when the objects of the meeting are of exceptional interest, and present some extraordinary attraction. On such occasions the number of those who are entitled to be present, exceeds the capacity of this, or any hall where the voice of the speakers can be distinctly audible, and the diagrams and maps visible from the more distant parts. The number of Fellows at the present time is 3199; and each Session, for several years, has brought an increase of from one to two hundred. Such numbers, without counting visitors, cannot be accommodated here, where, I believe, there are only seats for 1000. It is true all the Fellows are not in London, or in England probably, at any one time, and many do not attend, as a rule. But, on the other hand, as each Fellow, by the Rules of the Society, has the privilege of introducing a visitor, it will be seen that the

number of seats required on such occasions, as are here referred to, must be far in excess of any accommodation that can be provided. On the last event of this kind, when Lieutenant Cameron returned from his memorable "Walk across Central Africa," the Council engaged St. James's Hall for the meeting, in anticipation of the public interest that would be manifested, and the eager welcome that awaited him. That hall will, I believe, seat 1700 comfortably, and rather more on a press; but, notwithstanding this increased accommodation, many Fellows and their friends, it appeared, were unable to gain an entrance, and much disappointment unavoidably followed. Within what range, limited as this must be by the physical conditions of space, in connection with useful sight and hearing, a single Society can provide the requisite facilities for the accommodation and Geographical instruction of the public in this great Metropolis has not yet, perhaps, been very definitely determined. But it is obvious there are no means at the command of the Geographical Society, as at present constituted, to make provision for the accommodation of many thousand persons on any one occasion. In other respects, so long as we can be assured that there is no diminution of reputation, influence, or usefulness, it is difficult to regard this affluence of numbers as a subject of regret. Neither reputation nor usefulness depends altogether upon the meetings, or the attendance upon them. Many Fellows who seldom appear here, enjoy the advantage of our printed 'Journal' and 'Proceedings,' and the information they convey, together with access to the Map-Room and Library, daily enriched by new contributions and valuable acquisitions. Any attempt therefore to check the increase of numbers by fixing a maximum—or the attendance at these meetings by excluding the visitors, would, I believe, be alike open to objection. Societies, like nations, when they cease to increase, generally begin to decline; while continuous growth is an evidence of vitality and healthy vigour. We would not voluntarily exchange our present prospering condition for one of decreasing numbers, and possible stagnation, for want of the constant inflow of new blood, bringing fresh elements of strength and active life. As little, I may venture to predict, should we like to be without the inspiring presence of our visitors. They represent at these meetings the public, whose interest in our work is very encouraging and valuable. Its interest in that work, and approval of our efforts for the advancement of Geography in all its branches, are our main support, and lie at the root of much of our influence. Whatever may be said of Societies being "popular," to the disparagement of their claims to be considered "scientific," I should

be very sorry to see the Geographical Society shorn of its popular element. What it might gain in dignity, I feel sure, it would lose in usefulness, inasmuch as its means of affording instruction in a popular form would be seriously impaired. The ladies, who often grace our meetings with their presence, might lose something if the Geographical knowledge which is provided here, probably, in the form most acceptable to them, were no longer accessible; and I am quite certain the Society, and these meetings, would lose very much by their absence or exclusion. I allude to these matters now merely to point out the necessity of contenting ourselves with the great advantages we enjoy, without vainly disturbing ourselves, because there are some unavoidable drawbacks attending them.

I have been occupying you with some account of our prosperous condition—our rapidly increasing numbers and income; but the true measure of value does not consist in these—not even in popularity perhaps, however long enjoyed or fairly earned. Unless we can show that such influence as these conditions bring is being directed to wise and adequate ends, and conduces to the attainment of objects of public utility which might otherwise be missed, it would be a poor boast that we had great means at our disposal. I am glad to think, therefore, that, tried by this test, we shall not be found wanting. We may not only point with satisfaction to the valuable records of Geographical research and useful work to be found in the printed transactions of the Society, and the forty-five volumes of the ‘Journal,’ with their accompanying maps; but to great national undertakings for Geographical and scientific objects, such as the Livingstone East Coast Expedition and the Arctic Expedition. In both, the Society took an active part in promoting their inception and otherwise furthering their success. It was the advocacy of the Royal Geographical Society of London, reinforced by that of the Royal Society, which not only tended to keep alive public interest in the objects of the Arctic Expedition, but mainly determined, I believe, her Majesty’s Government to entertain proposals for its despatch. As regards the Livingstone Search and Relief Expedition, this Society very naturally took a leading part. Aided by public subscriptions and the assistance of the Government, we accepted the whole responsibility, and continued to the end, when all other resources failed, to supply the funds that were needed to bring its adventurous Commander back in safety. These are services which, I think, the Geographical Society may without vainglory or presumption, be permitted to regard with satisfaction as worthy and useful ends to have accomplished with the means at their disposal. The results obtained by these under-



takings cannot yet be fully determined. Before we can estimate their value in a Geographical or scientific sense, we must have before us the detailed accounts which, in due time, are certain to be furnished by the heads of the Expeditions, and we must wait patiently for them, knowing that, where such numerous scientific data have to be tested, classified, and their final outcome rendered in clear and intelligible form for public information, time and labour are both required. But of the Arctic Expedition we know sufficient already, independent of the more scientific results, to feel assured it brings with its return a conviction that a further advance to the North Pole by Smith's Sound is impracticable. Assuming this to be ascertained, I do not conceive, however, that it can with justice be considered a merely negative result. To me it seems a very positive and useful result to have achieved; for the next best thing to reaching the North Pole, is to demonstrate the impracticability of such an achievement, and so close the chapter of failures which have been attended with much loss of life, and years of serious suspense and anxiety. The mystery of "an open Polar Sea" has been dispelled, by what appears to be conclusive evidence that it has no existence. There has also been a gain to positive knowledge in demonstrating, for the first time, the true nature of the climate in the Polar area. We may rejoice that the British Flag has been carried nearer the North Pole than any other, in the van of all at  $83^{\circ} 20' 26''$ , and has been planted in the most desolate region yet discovered on the globe—only 400 miles from the Pole. Not indeed for the puerile vanity of being a few miles nearer the "earth's summit," but because to be the first in such a struggle, proves the possession of some of the best and highest qualities of our race—dauntless courage, physical powers of endurance of a rare order, sustained by unfailing energy and an unconquerable will. It is only men of such a type, the best and highest we know, who can win their laurels in endeavours to reach the Pole. It may be, as suggested the other day, that the "North Pole is no more interesting, *per se*, than any other part of the Arctic regions, and is merely that spot on the earth where the sun's altitude is equal to its declination"—but this which may serve as a scientific formula, gives no hold or place for the spirit of the Discoverers in all ages, to whom the unknown, presents an irresistible attraction,—nor the still larger class from which heroes spring, who need no other lure than the certainty of meeting danger and difficulty in their path, and the glory that attends success in triumphing over them. It is from the ranks of these chosen pioneers of our race in the regions of the unknown that

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Arctic Expeditions are recruited, and by them alone the noblest triumphs for science and civilisation are won in the fields of discovery. To them a waste of snow and a wilderness of rock, surrounded by ice barriers have no terrors. The limits of all navigation, beyond the furthest range of migration for birds or life for animals, where neither land nor water is, but only a frozen sea, with a night of five months, and a winter's cold ranging  $60^{\circ}$  below zero, only served to beckon them on to see what yet may lie beyond, in that great book of nature, ice-bound and "sealed throughout the ages" to all the human race, with frozen bands which take degrees of latitude in their span, and crush great ships between their folds, or fast lock them with a frozen grasp to the end of time.

I will not go further into the history of the Expedition and its dangers or difficulties, because I am enabled to announce that arrangements have been made by the Council of the Geographical Society for an Evening Meeting at St. James's Hall on the 12th of next month, when we may hope to have the pleasure not only of giving to Captain Nares and his companions the public welcome they have so richly earned, but of hearing, from his own lips, some of his experiences in the navigation of the Polar Seas. I trust we may also be favoured with an account by Captain Markham of his memorable sledge expedition, and from Captain Feilden, of the distribution of life in those frozen regions.

Turning now from the Polar Regions to the Torrid Zone, and the journey of Commander Cameron across the Continent of Africa south of the Equator from the Indian Ocean to the Atlantic. Although the scientific details are not yet before us, some general conclusions may safely be drawn as to the scope and value of the knowledge acquired. His journey, extending over a period of nearly three years, and in a large area west and south of Lake Tanganyika, over entirely untrodden ground, has enabled him to bring home a record of observations of great practical value. The final solution of the great problems connected with the lake and river systems of Central Africa, to the elucidation of which Livingstone devoted so many years of his life, has not yet been accomplished, but his contributions towards that end are of the highest interest. He has returned, too, satisfied of the practicability of opening up to trade all the South Equatorial region, and establishing trade routes across the continent from the Indian Ocean to the Atlantic. Perhaps no greater service could have been rendered as regards the civilisation of Africa and its future intercourse with the rest of the world. If legitimate trade by

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practicable routes, on land or water, can be established, the way will speedily be paved by peaceable means and civilising agencies, we may hope, for the suppression of the slave-trade and its accompanying horrors.

It was a fitting conclusion to the Livingstone Search and Aid Expeditions to have thus carried out, in the efforts made to reach him with effective aid, the great object of his self-sacrificing labours, and the one which he had most at heart. The purpose to which he devoted his life, in the spirit of a martyr, was the opening of Africa to civilisation and the Gospel. His work, published in 1865, was written, as he tells his readers, "In the earnest hope that it may contribute to the information which will yet cause the great and fertile Continent of Africa to be no longer kept wantonly sealed, but made available as the scene of European enterprise, and will enable its people to take a place among the nations of the earth, thus securing the happiness and prosperity of tribes now sunk in barbarism or debased by slavery; and above all, I cherish the hope that it may lead to the introduction of the blessings of the Gospel." Such was the truly Christian spirit in which this noble-hearted pioneer across the Continent of Africa engaged in his work of Geographical Exploration. And recalling some things which took place previous to the Zambesi Expedition, of which the work in question gives the narrative, he adds, "Most geographers are aware that, before the discovery of Lake Ngami and the well-watered country in which the Makololo dwell, the idea prevailed that a large part of the interior of Africa consisted of sandy deserts, into which rivers ran and were lost. During my journey in 1852-6 from sea to sea, across the south intertropical part of the continent, it was found to be a well-watered country with large tracts of fine fertile soil covered with forests and beautiful grassy valleys, occupied by a considerable population: the peculiar form of the continent was then ascertained to be an elevated plateau, somewhat depressed in the centre, and with fissures in the sides, by which the rivers escaped to the sea." This great physical fact, opened a new world, and coupled with the further knowledge supplied by Livingstone's explorations, that "The fabulous torrid zone," still to quote his own words, "of parched and burning sand, was now proved to be a well-watered region, resembling North America in its fresh-water lakes, and India in its hot, humid lowlands, jungles, ghauts, and cool highland plains," revealed a possible future until then undreamed of either by Geographer or philanthropist, and a vast field for the best influences of Christianity and civilisation, in com-

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bination with the development of a large legitimate commerce. Nor had Livingstone been less observant or less capable of appreciating these great elements of a future so rich in promise, could he have failed to note how much encouragement the history of the few years preceding his arrival on the West Coast afforded. He had forced his way there through every kind of peril, and difficulties innumerable, in order, as he said, "to find a path to the sea by which lawful commerce might be introduced to aid missionary operations." His reward was to find, as the result of our long and costly efforts for the suppression of the slave trade by our cruisers and treaties, that the slave trade was so far suppressed as to be spoken of by Portuguese who had themselves been slave-traders, as a thing of the past. He tells us he found "lawful commerce had increased from an annual total of 20,000*l.* in ivory and gold-dust to between 2,000,000*l.* and 3,000,000*l.*, of which 1,000,000*l.* was in palm-oil to our own country. Life and property were rendered secure on the coast, and comparative peace imparted to millions of people in the interior;" while "twenty missions had been established with schools, in which more than 12,000 pupils were taught." Efforts so speedily followed by such results might well receive support from statesmen of all parties, and commend themselves to the people of England for sympathy and aid: and the long-sustained interest of the nation in Livingstone's work, and the hearty and generous response made to every appeal for assistance, so long as there was hope that he still lived on the scene of his labours, was the reward of his arduous labours in this field of Geographical exploration. Cameron followed in the steps of Livingstone, and bravely took up the work which he had been unable to finish, but only relinquished with his life, to return with the full confirmation of Livingstone's most cherished hope that settlements might be made in healthy regions, and a legitimate trade take the place of the existing slave traffic,—with practicable roads into the heart of Africa, from the coast, both east and west: and uniting the great lakes with the Nile and the Mediterranean. Links are still missing for subsequent explorers to supply, but the great outline of such an undertaking is sufficiently complete now for immediate action to be taken upon a large scale. Indeed the work is proceeding at this hour with a rapidity and success which might well have seemed impossible ten years ago. Mr. Stanley is steadily working his way to the West Coast, after having circumnavigated the Victoria Nyanza, and added largely to our knowledge of that great inland sea. It has been reserved for him to prove that it is not a series of lakes or

lagunes, as had been surmised, and the valuable observations made during his progress of the lake and its adjacent coasts and affluents, has enabled Geographers to fill up great blanks in the map of those regions. The Church Missionary Society and the London Missionary Society are both engaged in founding mission stations in Central Africa. Their pioneer parties have been, and are now engaged in examining the routes into the interior from the coast near Zanzibar. According to the latest news, the Church Missionary Party, who aim at establishing a mission at Karagwé, have been exploring the two rivers, the Wami and the Kingani, with a view to ascertaining how far they may help by their navigability in facilitating access to the interior. The results have been discouraging; both rivers being found worthless, or nearly so, for the purpose required; but it is so much knowledge and valuable experience gained, and the preliminary explorations of the London Missionary Society have been very satisfactory. Their agent, Mr. Roger Price, has succeeded in proving, by personal survey and actual trial, the practicability of a bullock-waggon route from the coast as far as Ugogo, free from the plague of the Tsetze-fly. The point which this Society has chosen as a station for its operations is Ujiji on Lake Tanganyika.

The Established and the United Presbyterian branches of the Scottish Church are severally engaged in similar work.\* The

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\* The following letter from Mr. James Stevenson, of Glasgow, describing more accurately the relation of the Scottish Churches to this Mission, was received after my Address was in print:—

“Glasgow, 15th November, 1876.

“SIR RUTHERFORD ALCOCK, K.C.B., President of the Royal Geographical Society. Sir,—In yesterday's ‘Times’ I read in your able and comprehensive Address that ‘the Established and United Presbyterian branches of the Scottish Church have established a Memorial Station, Livingstonia, on the Lake Nyassa, and launched a steamer upon its waters.’ As this will occasion much comment here, although it may appear of little importance in England, allow me one or two remarks in correction.

“The recent initiation of Missions in the interior was the work of the Scottish Free Church, which, fourteen years ago, when the Universities Mission was at Magoemo, surveyed the ground, last year founded the settlement of Livingstonia, entirely paid for and, under the supervision of Mr. Young, B.N., who is still in her service, launched the steamer on the Lake, and maintains it there.

“What has created misconception is the circumstance that the Free Church allowed a member of the Established Church to go with their party eighteen months ago to look for a site for an Established Church Mission, quite apart from Livingstonia, and the liberality of the United Presbyterian Church, which sent and paid the salary of an able medical Missionary till the education of the ordained medical man designated by the Free Church should be completed.

“I may properly add, that all the Scottish Missions in Southern Africa, with the single exception of a Mission of the United Presbyterian Church, whose principal work is in Western Africa, and the Scotch Episcopal Mission in Pondo Land, belong to the Free Church; as it was the possession of these bases of operation that was one ground for the advance northwards.

Scottish Free Church last year founded a memorial station, Livingstonia, on the Lake Nyassa, and launched a steamer upon its waters, under the auspices of that admirable pioneer Mr. E. D. Young, with whose name and deeds we are all familiar. And all this—perhaps the most gratifying feature of the whole—is being done with the entire concurrence of the Native Chief of the district. This last mission is established at the mouth of a fertile valley, with anchorage for small vessels on the lake in front of an island opposite.

On the north, from the side of the Nile, Colonel Gordon continues his operations in the direction of the equatorial lakes, and under his judicious direction several of his subordinates, in the course of their other duties, have made explorations of great importance. Thus, early in the present year, he entrusted to a member of his staff, M. Gessi, the task of tracing the Nile up to its outlet from Albert Nyanza and circumnavigating the lake. A brief account of the successful achievement of this task reached us before the end of our last Session; but since then I have been favoured with a detailed report of the journey by M. Gessi himself, a translation of which I directed, during the vacation, to be inserted in the public journals. From this, it will be seen that M. Gessi believed he had defined the southern boundary of the lake, although unable to reach the extreme end, owing to the aquatic vegetation and the shallowness of the water. The recent letters of Mr. Stanley, however, who reached the shores of the same lake some weeks later, seem to show that it extends much further to the south than indicated by M. Gessi. At least the description of the Beatrice Gulf, a feature not seen by Gessi, and the direction of Stanley's route, point to this conclusion. Whilst Gessi was engaged on this important exploration, M. Piaggia had been re-examining the new lake, first seen by Colonel Long, in the course of the Nile between Foweira and Victoria Nyanza, and had brought back to Colonel Gordon's headquarters information fully confirming Colonel Long's account, the basin being 50 miles in length, and having, further, the interesting

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“For the purpose of setting the matter accurately before the public that a just view may be taken, may I suggest that a communication to the ‘Times’ might be sent, if no equally prompt means is available.

“I may remark that, in order to carry out the task which Sir Bartle Frere prevailed on the merchants of Glasgow to undertake in connection with the Brussels Congress, it seems to be almost essential to have the assistance of the Free Church steamer, and also of some of the educated natives from her institutions. We can certainly ask it with a better grace if we do not ignore the services she has already rendered in the exploration of the Lake by means of those in her employ, not to speak of her being the first, in fact up to this time, the only body located in the interior north of the Zambesi. I am, &c. JAMES STEVENSON.”

feature of a second outlet, on the north, in the direction of the Sobat River. According to the latest accounts, Colonel Gordon was preparing to transport his little steamer in sections to Ripon Falls, there to be launched on Victoria Nyanza.

One of the most important results perhaps of the Livingstone Aid Expedition—in succession to his own philanthropic and geographic labours—has been a step taken by the King of the Belgians during the recess. It had become evident, after the experience gained by Cameron, that the cost of prosecuting further explorations, to the extent necessary for the attainment of such desired ends, was far beyond the reach of private enterprise, or any means at the command of Geographical Societies. Some 11,000*l.* has been expended on the Cameron Expedition, and if Central Africa is to be opened to commerce and civilisation in this generation, it can only be by a collective and united effort, and many simultaneous expeditions of nearly equal difficulty and cost. If no views of conquest or annexation be entertained, all the civilised world may cordially join in overcoming the difficulties and supplying the funds needed for so large an undertaking. But a definite purpose, great command of means, and responsible direction towards a common end, must in a great degree take the place of such isolated efforts as have heretofore been the rule. It was with these large and disinterested views that a congress or conference of travellers, geographers, and statesmen from different countries assembled at the Palace in Brussels, at his Majesty's invitation, in September last. With the advantage of all the scientific knowledge and practical experience of many African travellers and Geographers, including the Presidents of the principal Geographical Societies of Europe, the Congress was occupied during several successive days in discussing the best means of opening Central Africa. I will not detain you by details as to the plan of operations contemplated, or the organisation provided for giving permanence to the movement thus initiated, as the proces-verbal of the proceedings is on the table, and may be consulted at leisure, by all who are interested, at the rooms of the Society. I may state, however, for general information that the Congress before its close adopted resolutions for the constitution, in a permanent form, of an "International Commission of Exploration and Civilisation of Central Africa;" and of "National Committees," to be formed in each country. These would be in correspondence with the International Commission as a common centre for the general direction, under an "Executive Committee," presided over by the President of the Commission, of combined operations and exploratory expeditions, and for the em-

ployment of any funds transmitted by the National Committees. The King himself graciously acceded to the wish of the Congress that he should be the first President of the International Commission and its Executive Committee, and it only remains now that the National Committees should be effectively constituted to promote the objects contemplated.

It was announced by his Majesty that Madame Heine has contributed 20,000 francs, and no doubt is entertained that a large and generous support will be readily obtained, not in one country only, but among all nations of European race. And since that date information has been received here that the National Committee for Belgium has been definitively constituted, with H.R.H. the Count of Flanders at its head, and more than sixty influential names have been obtained. I also learn that several Sovereigns and Princes have expressed their sympathy, and consented to be enrolled as honorary members of the "International Commission." I am glad to be enabled to state that H.R.H. the Prince of Wales has consented to be the Patron and President of the National Committee for the exploration and civilisation of Africa, now forming in this country. I may further mention that an influential meeting was held on the 10th inst. at Glasgow, in the Hall of the Chamber of Commerce, under the presidency of Sir James Watson, and resolutions were passed constituting a committee to form a Scottish Branch of the British National Society, for the purpose of raising funds, and memorialising Her Majesty's Government to aid in the surveys required to ascertain the practicability of making a road from the northern end of Lake Nyassa to the south end of Lake Tanganyika, and also from the north end of that lake to the seacoast at a point north of Cape Delgado. If a scheme of international co-operation were carried out, as much, I believe, might be done in five years as could otherwise be accomplished in fifty. I do not see that it is at all beyond the bounds of practicability for Africa to be spanned across from East to West by a line of communication, and the Mediterranean similarly connected to Lake Nyassa in the South by the Nile and roads branching off to all the lakes. Within a short period we might have a line of telegraph from Khartoum, on the Nile, to the Diamond Fields in the Cape, to which points it is now extended, and so be opened from one end of Africa to the other. These things are perfectly possible, with public sympathy, co-operation, and support.

Sir Bartle Frere, whose labours in the cause of humanity and for the repression of the African slave trade, are so well known and highly appreciated, was my colleague, together with Sir Henry



Rawlinson, at the Congress : and Sir Bartle has lately given so clear and succinct a statement of the field for philanthropic work now offered by Africa south of the Equator, in an address read at Plymouth, at the Church Congress held there, and of the means by which the King of the Belgians hopes to effect great and rapid results in the interest of humanity and civilisation, that I must beg permission to quote his own words :—" Central Africa," he observes, " had for ages been almost closed or lost to the rest of the world, except as a nursery or hunting-ground for slaves. Admirably adapted by nature for producing and exporting almost every kind of tropical or sub-tropical raw produce, and for consuming in large quantities the products and manufactures of the rest of the world, Central Africa had for three centuries exported little except slaves, every one of whom had been proved in the clearest manner to be procured at the cost of many other human lives, while the process of hunting for them kept the whole country in a state of perpetual insecurity and barbarism. The annual loss of life has been repeatedly proved to be some hundred times greater than the slaughter in Bulgaria, which has so recently shocked the whole civilised world. No one who had any instinct of humanity could refuse to aid in putting a stop to such a horrible waste of human life, and of the good gifts of the Almighty ; but how was this to be effected ? Governments and diplomatists had done, and were doing, their part, but they could achieve little without the aid of explorers and enterprising travellers to penetrate regions where mistrust of every man's neighbour had hitherto barred the road to all but the armed bands of slave-hunting men-stealers. Naturalists and men of science must follow the explorers to ascertain and report the natural riches of the country ; missionaries must follow to teach and civilise, and men of commerce to trade and assist the development of lawful industry. At present those interested in behalf of Central Africa for opening roads and forming stations which should be centres of security and civilisation, were working separately and losing time, energy, and money. The idea of the King of the Belgians is by means of an International Association to unite all these efforts as far as they had common objects in view ; to make known to all interested in the work the scattered items of information which now escaped notice in separate transactions and reports ; to concert united action where united action was necessary or practicable ; and to aid in laying before the Governments and communities of the civilised world such requisites of their great task as could only be supplied by national or diplomatic effort. One of the first wants is, of course, to open roads, and to establish

stations which might serve as points of refuge for the weak and needy, as bases of further operations for the explorer and men of science; as resting-places for the traveller and missionary; and as centres of commerce. All experience shows that the establishment of such stations is not only practicable, but that it is the only way in which the objects I have enumerated can be effectually promoted."

I am unwilling to leave the subject of the Brussels Congress which deserves to be memorable from the importance of the questions discussed, and the high purpose directing its deliberations, without some reference to the part taken by its Royal President. At a recent meeting of the Geographical Society of Berlin, Baron von Richthofen, its distinguished President, referring to the initiative of the King, and the manner in which the delegates to the Congress were received, said that, "In no country and on no occasion has so grand and Royal a hospitality been exercised." Science and philanthropy could not have been united under higher or better auspices. Distinguished among the crowned heads of Europe for his devotion to objects of general utility and international scope for the benefit of mankind at large, his action in so great a scheme as the opening of Africa and the suppression of a slave-trade which devastates the whole Continent, and fills it with suffering and bloodshed, was singularly appropriate. And, indeed, Royal sanction and high influence was needed to embolden any one to join in so vast an undertaking. Some of the powers of Sovereignty also may be needed, to give validity by consular authority to various acts in treating with the native tribes and their chiefs. With reference to the gracious reception and hospitality extended to every member of the Congress, I can only say that coming from the King of the Belgians it was a graceful recognition of the claims of science, and more especially, perhaps, of the Geographical Societies so largely represented on that occasion, and so directly concerned in showing the way into the heart of Africa.

It seems only necessary further to mention that, as the objects contemplated by the Congress were not even mainly Geographical, and this Society has always carefully avoided overstepping the proper limits of Geography in any action it has taken, due care was observed by myself and colleagues that it should in no sense be committed. But inasmuch as the chief instrument of success must be Geographical Explorations, and nothing will more effectually promote their successful prosecution in the interest of science than the opening of the interior of Africa to commerce and the

influences of civilisation, it is naturally to be expected that all the Geographical Societies will feel anxious to give their cordial support to all such operations as properly come within their sphere, reserving at the same time perfect freedom of action and independence.

During the recess the British Association for the Advancement of Science also held its usual Annual Meeting, the Geographical Section being presided over by our eminent colleague, Captain Evans, who delivered, at the opening of the sectional business, an address dealing chiefly with the Physical Geography of the ocean. Original and suggestive in the highest degree, it especially deserves the attentive consideration of all who are interested in the scientific branches of Geography, on which I shall presently have to speak more at length. Many papers of great merit were read, the authors of some of which I hope may appear before our Society during the present Session. I would particularise those referring to the voyage of the *Challenger* by Commander Tizard, Mr. Murray, and Mr. Buchanan, three members of the Expedition, who gave summaries of the results of the observations made, each in his own department, during their memorable voyage. Thus Commander Tizard reviewed the temperature of the Atlantic, Mr. Murray the Geographical distribution of the deep-sea deposits, and Mr. Buchanan the specific gravity of the surface water of the ocean. Of Papers on Descriptive Geography, there were five relating to Africa; the one attracting most attention being that of Commander Cameron "On the Watersheds and River Navigation of Central Africa." The others being one, by Colonel Playfair on his recent Travels in Tunis in the footsteps of Bruce—a paper of great interest to Historical Geographers; one by Mr. Bowden on a new route (through Liberia *viâ* Musardu) to the Sources of the Niger; and others by Lieutenant Chippindall on the White Nile above Gondokoro, and by Captain Hay on the District of Akem in West Africa. Two important Papers were also read on New Guinea, both by gentlemen recently returned from personal exploration in that great island, namely, one by Mr. Octavius Stone on the Interior District near Port Moresby, and one by Signor Cerutti on the North Western Coast.

The "Oriental Congress" assembled in St. Petersburg this autumn, and some Geographical papers of great interest were read. I am informed by Captain Clarke, who, attended as a delegate from this Society, that they were most cordially welcomed by the Russians, and that the Provisional Committee paid a compliment to the Royal Geographical Society in appointing all the Fellows present

to some office—Captain Clarke and Mr. Eastwick being elected Vice-Presidents of one of the Sections, Mr. Robert Cust a Vice-President of the Caucasus Section, and Mr. Delmar Morgan one of the Foreign Secretaries, for which post he was eminently qualified by his knowledge of the Russian language. Although some of the communications bearing on Geography were, as I have said, very interesting—with regard to Central Asia, of which country it might have been expected something new would be learned, little was added to our previous knowledge. Captain Clarke was, by the kindness of the authors, in one or two cases lent the original papers; but as these are in Russian, and it will take some little time for him to translate them, I have not yet received the report of their contents.

I also learn that Colonel Sosnofsky, the chief of the Expedition which started from China in 1874–5 to explore a new trade route between Nanking and the Zaisan Fort (by way of Hankow, Hanjun-foo, Gan-chan-foo, Hanjow-foo, Hami, Barkiul-gu-chen, and Chuguchan), an expedition the importance of which in its bearing on the future relations of Russia and China, and the course of trade across Central Asia, is but little understood in England, has asked Captain Clarke to convey, as a present to the Royal Geographical Society, an Album containing a series of Photographs taken during the Expedition, by M. Bosiarsky, who was attached to the Mission.

Russian explorers appear to be as actively engaged at the present moment on the confines of China and Mongolia, as they have long been in Central and Western Asia. We have had quite recently, thanks to Mr. Delmar Morgan, an English version of the narrative of the Travels of Lieutenant Colonel Prejevalsky in Mongolia, the Tangut country, and the solitudes of Northern Tibet, a work replete with information and interest. England and Russia are both interested in all that improves our knowledge of the inhospitable regions between the southern borders of Siberia and Eastern Turkestan, including great part of Mongolia, Tartary, and Tibet. The caravan routes and centres of trade lie across this vast space separating Peking from Yarkand, to which latter mart all roads converge for the supply of Central and Western Asia. The upper course of the Blue River (the Yangtze) which was reached by the Russian explorers, lies in Northern Tibet. We must see, with Colonel Prejevalsky, that Geographical Exploration in this terra incognita of Eastern High Asia—extending from the mountains of Siberia in the north to the Himalayas in the south, and from the Pamir to China proper, from west to east, and situated in

the centre of the greatest of all the continents,—presents, from a scientific point of view, grand and varied fields of research.

Colonel Sosnofsky read no paper himself, and the first part of his Report to his Government, now printed, is not very instructive or satisfactory; but, to judge by the following account in the 'Turkestan Gazette,' the Expedition was one of the greatest interest and importance. We are told that "The Expedition of Colonel Sosnofsky to Western China for the purpose of exploring a new route has been successful. A road has been found nearly 1400 miles shorter than that by Kiachta. This road, from Lan-chu (on the Yellow River) to Zaisan, is perfectly fit for wheeled vehicles; it passes through a populous, fertile and well-watered plain, and only for three days does it traverse a sterile district. From Zaisan it passes through Semipolatsinsk and Omsk." Nothing could better illustrate the value and importance of such Scientific and Geographical Explorations than this discovery of a nearly direct line of road, through a populous and fertile district from the centre of China to the great marts and railroad network of Russia, instead of a wide circuit through arid steppes and the shifting sands of the desert, which for so many centuries has been the line trade has taken between Russia and China *via* Kiachta. Mr. Price's discovery in Africa of a practicable waggon-road from the East Coast, free from the Tsetse-fly, to the high land and the lake regions, is another example of the important part which Geography plays in the affairs of nations.

The great object of the Russians on the western or Tibetan side is to establish a trade from Semipolatsinsk, on the line to Orenberg and Novogorod, to the central provinces of China through Mongolia—and to the far east on the banks of the Amoor, Russia is probably seeking—what may be considered a Geographical necessity in Eastern as in Western Asia—a good seaport, open at all seasons. With such great national objects in view, of primary importance both in a commercial and political point of view, it is easy to understand the intense activity with which these geographical explorations are pushed, and no country is better served, as a rule, by a staff of scientific and hardy officers. Undeterred by vast distances, or pathless deserts and hostile Nomads, they carry on their work; and we, as Geographers, are ready to do honour to their energy and useful labours in such inhospitable regions.

It only remains now that I should very briefly speak on a subject of considerable interest and importance, which has occupied the Council since Sir Henry Rawlinson gave you in his closing Address his very able and exhaustive summary

of Geographical progress during the last Session. I mentioned at the last Meeting that it was in contemplation to extend in a more strictly scientific direction the range of the Geographical work the Society had hitherto prosecuted, and to allocate for this end a sum not exceeding 500*l.* annually out of its income, for the promotion of special scientific Geographical investigations in any part of the world, as distinct from mere exploration. One of three directions in which the Committee appointed to consider the subject recommended our efforts to take was the delivery, by persons of recognised high attainments, not less than three lectures at the ordinary Evening Meetings each Session on Physical Geography in all its branches, as well as on other truly scientific aspects of Geography in relation to its past history, or the influences of Geographical conditions on the earth's surface and on the human race. Captain Evans well remarked in his opening Address at Glasgow, speaking more especially of navigators and maritime discoveries, that, "With our present knowledge of the sea-board regions of the globe, little remains except in Polar areas for the navigator to do in the field of discovery," and the same remark might be made of Geographical discovery on land. It is to the development of the scientific features of Geography that the attention of travellers and explorers, whether on land or water, require now to be mainly directed, and in this there is an illimitable field. The progress of science and exact knowledge in every direction creates new exigencies. Distinction to the future explorer can only be secured therefore by a certain scientific training. It can no longer be won by mere descriptive power, or the report of physical features and topographical details. These must now be accompanied by instrumental observations of an order sufficiently high to place numerically before Geographers all the characteristics of the explored region. The days have long passed when Marco Polo and his successors could satisfy all demands by giving the history of their journeys and incidents of travel—supplying only approximate distances and relative situation of the places they mention, calculated by the number of days' journey between each—a measurement of the most dubious kind, as subsequent observations of a more scientific character have shown. No doubt such scientific appliances to supplement the traveller's work of mere exploration or discovery imply the cultivation of branches of science not "strictly pertaining to Geography" as this is commonly understood. But this intrusion into other domains of science is unavoidable. They must of necessity be imported into and made tributary to Geo-

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graphy, in order to give to this its proper uses and full development. Neither Astronomy, Mathematics, or Geology, nor Natural History or Botany, enter into any popular conception of Geography—or form any part of the qualifications held necessary for its successful study and advancement. But this forcible intrusion, and a certain overlapping of boundaries, must take place more and more as knowledge advances, by the essential interdependence of each science as parts of a whole, only apparently separable by arbitrary lines of limitation. We need not fear, however, that all distinctions will be effaced, or that Geography will lose any of its interest or value by its being more closely allied with scientific processes. It would be easy indeed to demonstrate, that within proper limits, such scientific extension brings out new features of utility and interest, showing capabilities in Geography to meet the requirements of commerce and to furnish valuable data for the advance of national objects, without which indeed neither the minister in his cabinet, nor the general in the field, can successfully carry out a national policy in the conduct of foreign affairs. I must, however, content myself with referring you for the best demonstration of this fact, to three addresses delivered in the Geographical Section of the British Association for the Advancement of Science, by members of this Society, in three successive years. I allude to the addresses of Major Wilson, at Belfast, in 1874, of General Strachey, at Bristol, in 1875, and Captain Evans, at Glasgow, this autumn. All of these have been deemed of sufficient interest and importance to be inserted in our 'Proceedings' for the information of the Fellows, but I would still beg to be allowed to again commend you in connection with our proposed action, to give them the attention they so well deserve on other grounds. Major Wilson, taking for his subject the influence which the physical features of the earth's crust have on the course of military operations, and the consequent importance of the study of Physical Geography to all who have to plan or take part in a campaign, has shown not only by a large and varied field of induction, but by striking examples, drawn from recent history, how great a part Geography in all its branches plays in deciding the issue of military operations, and with them the destiny of nations. How much, indeed, the successful issue of a war, may depend on a previous knowledge of the physical character of the country in which it is waged, may be shown by the whole course of history, and fully justifies the remark that if the fate of a nation may depend on a battle, that, in its turn, may depend on a knowledge of Geography. Not the Geography which merely notes the course of rivers or the direction and

height of mountain-ranges, and the distribution of high roads or railways, but all the conditions of soil and climate, of rainfall, and its effects on vegetation, of forest and marsh, and their influences on the health of the district; all circumstances which render the subsistence, march, or sanitary conditions, of large bodies of men difficult or impossible. It may be truly said of more than the Franco-German War, that it was "a war fought as much by maps as by weapons."

If we turn to General Strachey's admirable address on Physical Geography as a science, the whole field of Geographical exploration and research is there effectively dealt with in a comprehensive survey. The able writer was not satisfied to dwell on the practical influence produced by the Geographical features and conditions of the various parts of the earth on the ordinary affairs of men and the world,—or even "the past history and present state of the several sections of the human race, the formation of kingdoms, the growth of industry and commerce, and the spread of civilisation"—though to many these are the aspects of Geographical study which possess the greatest interest. He preferred to treat of the physical causes which have impressed on our planet the present outlines and forms of its surface—which have brought about its present conditions of climate, and have led to the development and distribution of the living beings found upon it. And with this for his theme, he has traced the probable future of Geographical investigation. For although, as we are told, "much yet remains to be done in obtaining detailed maps of large tracts of the earth's surface, yet there is but comparatively a very small area with the essential features of which we are not now fairly well acquainted." From this fact, and others referred to, the conclusion is deduced that "the necessary consequence is an increased tendency to give to Geographical investigations a more strictly scientific direction as the demands for more exact information become daily more pressing." In proof of this, he cites the fact, that the two British naval expeditions which have just concluded their voyages (the *Challenger* and the Arctic ships) were "organised almost entirely for general scientific research, and comparatively little for topographical discovery." So also the great advance made in every branch of Natural Science, while it shows more clearly the interdependence of all natural phenomena, it limits, at the same time, the power of attaining the highest knowledge in more than one or two special directions; and it is the more important that some, among the cultivators of natural knowledge, should direct their attention "to the general relations

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existing among all the forces and phenomena of nature." In some important branches of such subject, he goes on to show "it is only through study of the local physical conditions of various parts of the earth's surface, and the complicated phenomena to which they give rise, that sound conclusions can be established; and this study constitutes Physical or Scientific Geography, which is still more closely defined as a study, the 'true function of which is that of obtaining accurate notions of the manner in which the forces of nature have brought about the varied conditions characterising the surface of the planet which we inhabit.'"

Captain Evans, in the third of these instructive Addresses, states his conviction that "It is to the development of the scientific features of Geography that the attention of voyagers requires now to be mainly directed:" and on the Physical Geography of the sea, which he takes for his theme, he goes on to show first that it is difficult, not to say impossible, to prevent a certain overlapping of scientific boundaries, with the expansion of knowledge, or to "see how the several included branches of Physics can be separated from pure Geographical science." And secondly, how full of practical interest and importance in human affairs is the knowledge of Navigation, and that the impetus first given to deep-sea exploration no doubt was derived from the demand chiefly for commercial interests for electrical telegraphic communication between countries separated by the ocean.

But I must not longer trespass upon your time. I will only add that the arrangements for carrying out all the recommendations of the Committee are not yet completed, but I have the pleasure to announce that General Strachey has consented to give the first of the Lectures this Session on the general subject of Geography in its scientific aspect. Dr. Carpenter will deliver the second, on the Physical Geography of the Ocean, and Mr. Wallace the third, on the Influence of Geographical Conditions on the Comparative Antiquity of Continents as indicated by the Distribution of Living and Extinct Animals. I will only further add that, as regards the contemplated grants, 1st, to assist persons in undertaking special scientific Geographical investigations as distinct from mere exploration in any part of the world; 2ndly, to aid in the compilation of useful Geographical data, and preparing them for publication; and, 3rdly, for making improvements in apparatus or appliances useful for Geographical instruction, or for scientific research for travellers.—the Council will be happy to receive applications for consideration under any of these heads.

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The following Paper was then read by the Author :—

*On the Buried Cities in the Shifting Sands of the Great Desert of Gobi.*

By SIR T. DOUGLAS FORSYTH, K.C.S.I.

AMONG the many objects of interest which attracted our attention during the late Mission to Kashghar, not the least interesting was an inquiry regarding the shifting sands of the Great Desert of Gobi, and the reported existence of ancient cities which had been buried in the sands ages ago, and which are now gradually coming to light.

When Mr. Johnson returned in 1865 to India from his venturesome journey to Khotan, he brought an account of his visit to an ancient city not far from Kiria, and five marches distant from Khotan, which had been buried in the sands for centuries, and from which gold and silver ornaments, and even bricks of tea were dug out.

On the occasion of the first mission to Yarkund in A.D. 1870, we were unable to gather much information, and I observe that in Mr. Shaw's book, 'Travels in High Tartary,' no allusion to the subject is made. Tara Chund, the energetic Sikh merchant whom Mr. Shaw mentions, and who accompanied me on both my expeditions, told me that this exhumed tea was to be found in the Yarkund bazaar; but as our stay in that city in 1870 was of very short duration, and we had no opportunity of moving about and making inquiries for ourselves, we returned to India with very vague ideas on the subject. On my second visit in 1873, I determined to make more searching inquiries, and for this purpose I endeavoured to collate all the information obtainable from published works, as well as from Oriental books, such as Mirza Haidar's 'Tarikhi Rashidi,' a valuable copy of which I picked up in Kashghar. I also consulted many natives of the country, and other authorities. And the first of all authorities unquestionably is Colonel Yule. Not only has this distinguished Geographer, by his laborious researches and translations, thrown a flood of light on the history and Geography of Central Asia, and given to the world an invaluable commentary on the travels of Marco Polo, and other mediæval explorers, but I gladly take this opportunity of recording the deep obligations under which he placed myself and all the members of the Mission to Kashghar by the valuable hints and information he supplied to us from time to time. To him I was indebted for the loan of a copy of Rémusat's 'Histoire de la Ville de Khotan,' a most useful work. Colonel Yule very justly remarks, regarding the great Venetian traveller of the middle ages,

that all the explorers of more modern times have been, it may be said, with hardly a jot of hyperbole, only travelling in his footsteps; most certainly illustrating his Geographical notices.

It is only proper then to place Marco Polo at the head of the list of authorities to whom I shall refer. The 36th and three following chapters refer to the country in which we are at present interested. His chapter on Khotan is provokingly meagre, for there is very great interest attaching to this place. It is supposed by some that this city was the limit of Darius's conquest. I have several Greek and Byzantine coins which were found in the ruins of the city near Kiria.

We know that in early ages it was inhabited by political exiles from India, that the Hindoo religion flourished there; and I have some gold ornaments found there, which are exactly the same as those worn by the Hindoo women of the present day. In Rémusat's History we read how the King of Khotan took an army across the Snowy Mountains and attacked the King of Cashmir, and how peace was made between the two countries, and the result was that certain Rahaas or Ascetics brought the Buddhist religion into the country; and in the 'Tarikhi Rashidi' we read how a Christian Queen, wife of Koshluk, ruled in the land and made proselytes to her religion.

I will not enlarge now on the frequent intercourse in former ages between Khotan and India; but I may, however, here correct an erroneous impression which was conveyed to the Members of the Royal Geographical Society at its last Session. A good deal was said regarding the impenetrable barrier raised by the Himalayas, and Colonel Montgomerie said that the only army which ever crossed went from the Indian side and never returned. But, not to refer to invasions of ancient times mentioned by Rémusat, Mirza Haidar, in his 'Tarikhi Rashidi,' gives graphic descriptions of an expedition under Sultan Saïd and his minister, Mirzir Haidar, from the Yarkund side, which was very successful, and on the road between the Susser Pass and the Karakorum we passed the wall which had been erected by the Rajah of Nubra to help to assist the invasions of the armies of Khotan and Yarkund.

The 37th chapter of Marco Polo relates to Pein, and it is evident that at that time the city called by that name was in existence. From the geographical description given by Colonel Yule in his valuable notes on this chapter, I should say that Pein or Pima must be identical with Kiria. Colonel Yule's remark regarding the looseness of morals in the towns of Central Asia is doubtless correct, but I record the fact that the present ruler of Kashghar professes to

enforce a very strict code of morality. It is peculiar of its kind, but it is supposed to be framed on the Koran, and according to the practice of orthodox Mahommedans. and he would be horrified if he knew that the accommodating rules of the Shias were supposed to prevail in his country. One of his followers once, speaking to me in no measured terms against the Shias, said he would have as much pleasure in slaying a Shia as an infidel, and his language would remind one of the animosity displayed by Catholics and Protestants to each other in days not very long gone by.

As regards Charchan, or Charchand, we got some information from persons who had been there. It is a place of some importance; and was used as a penal settlement by the Chinese, and is now held by a Governor under the Ameer of Kashghar. It contains about 500 houses, situated on the banks of two rivers, which unite on the plain, and flow to Lake Lop. The town is situated at the foot of a mountain to the south, and the river which flows by it is said to come from Tibet.

Captain Trotter has remarked that the exact geographical position of Charchand is not fixed with any degree of certainty; but it is probably about equidistant from Kiria and Kurla, and he gives the marches from Khotan to Charchand, *viâ* Kiria:—

Khotan to Kiria .. ..	4 marches = 104 miles.
Kiria to Charchand .. ..	14 marches = 280 or 300 miles.
Total .. ..	384 or 400 miles.

Marco Polo describes the whole province as sandy, with bad and bitter water; but here and there the water is sweet. This agrees with the information we obtained, which was that, between Charchand and Lop, there are oases where wandering tribes of Sokpos, or Kalmaks, roam about with their flocks and herds. I was informed that the present Governor of Khotan rode across from Kurla direct in fifteen days, a distance of about 700 miles.

The stories told by Marco Polo, in his 39th chapter, about shifting sands and strange noises and demons, have been repeated by other travellers down to the present time. Colonel Prejevalsky, in pp. 193 and 194 of his interesting 'Travels,' gives his testimony to the superstitions of the Desert: and I find, on reference to my diary, that the same stories were recounted to me in Kashghar, and I shall be able to show that there is some truth in the report of treasures being exposed to view. I give the following from Colonel Prejevalsky's words:—

"The sands of Kugupchi are a succession of hillocks, 40, 50, rarely 100 feet high, lying side by side, and composed of yellow

sand. The upper stratum of this sand, when disturbed by the wind blowing on either side of the hills, forms loose drifts, which have the appearance of snowdrifts.

"The effect of these bare yellow hillocks is most dreary and depressing when you are among them, and can see nothing but the sky and the sand; not a plant, not an animal is visible, with the single exception of the yellowish-grey lizards (*Phrynocephalus* sp.), which trail their bodies over the loose soil, and mark it with the patterns of their tracks. A dull heaviness oppresses the senses in this inanimate sea of sand. No sounds are heard, not even the chirping of the grasshopper; the silence of the tomb surrounds you. No wonder that the local Mongols relate some marvellous stories about these frightful deserts. They tell you that this was the scene of the principal exploits of two heroes—Gissar Khan and Chinghiz Khan. Here these warriors fought against the Chinese, and slew countless numbers, whose bodies God caused the wind to cover with sand from the Desert. To this day the Mongols relate, with superstitious awe, how cries and groans may be heard in the sands of Kugupchi, which proceed from the spirits of the departed; and that every now and then the winds, which stir up the sand, expose to view different treasures, such as silver dishes, which, although conspicuous above the surface, may not be taken away, because death would immediately overtake the bold man who ventured to touch them."

When I was at Peking last spring I had the good fortune to meet Dr. Bretschneider, physician to the Russian Legation, an accomplished Chinese scholar, whose Notes on Chinese mediæval travellers to the west contain valuable information. One of these travellers, Kin Ch'ang-chun, thus writes of his journey across the Great Desert in A.D. 1221:—"Whoever crosses that place in the daytime and in clear weather (*i.e.* exposed to the sun), will die from fatigue, and his horses also. Only when starting in the evening, and travelling the whole night, is it possible to reach water and grass on the next day by noon. After a short rest, we started in the afternoon. On our road we saw more than a hundred sand-hills, which seemed to swim like big ships in the midst of the waves. The next day, between 8 and 10 o'clock in the morning, we reached a town. We did not get tired travelling at night-time, only were afraid of being charmed by goblins in the dark. To prevent the charms, we rubbed the heads of our horses with blood. When the master saw this operation, he smiled, and said goblins flee away when they meet a good man, as it is written in the books. It does not suit a Taoist to entertain such thoughts."

One thing strikes me as remarkable, that though, as I suppose, Marco Polo visited Khotan, and passed along the road to Lop, he nowhere mentions the report of buried cities being in existence. Mirza Haidar, writing two centuries afterwards, alludes to them; and we learn from Chinese authorities that they were known to have been buried many centuries before Marco Polo's time.

Before passing to other authorities, I may make a remark on one of Colonel Yule's Notes on this chapter. He speaks of the cities of Lop and Kank. But this Kank is, I think, probably the Katak mentioned by Mirza Haidar. The word in Persian is written كك, and it depends on the diacritical points in the middle letter whether it is كك (Katak) or كك (Kank). In the copy of the 'Tarikhi Rashidi' I have it is Katak, and this is the version adopted by Dr. Bellew.

Mirza Haidar gives an account of the destruction of this city of Katak. According to him, the fate of the city had long been foreseen in the gradual advance of the sand; and the Priest of the city repeatedly warned his audience, in the Friday sermons, of the impending calamity; and, finally, seeing the danger imminent, he informed his congregation of a Divine order to quit the city, and flee from the coming wrath of God. He then formally bid them farewell from the pulpit, and forthwith took his departure from the doomed abode. He left the city, it would seem, in a violent sand-storm, and hurried away with his family, and such effects as he could carry with them. After he had gone some way, one of his companions (the muezzin, or crier to prayer of the mosque) returned to fetch something left behind, and took the opportunity to mount the minaret, and, for the last time, chaunt the evening call to prayer from its tower. In descending, he found the sand had accumulated so high up the doorway that it was impossible to open it. He consequently had to reascend the tower, and throw himself from it on the sand, and then effect his escape. He rejoined the Sheikh at midnight; and his report was so alarming, that they all arose and renewed their flight, saying, "Distance is safety from the wrath of God."

Such is the story told by a pious Mahommedan regarding the evil consequences of rejecting Islam. But a similar tale is told by the Chinese of another town, at or near Pima, which was destroyed in a somewhat similar manner in the sixth century A.D., in consequence of the neglect of the worship of Buddha. On that occasion, it is said, that there was a violent hurricane for six days, and on the seventh a shower of sand fell and buried at once the whole city.

From the inquiries made by Dr. Bellew, and others of our Mission, it appears that the large town of Lop, mentioned by Marco Polo, exists no longer; but there are numbers of encampments and settlements on the banks of the marshy lakes and their connecting channels, perhaps there are as many as a thousand houses or camps. These are inhabited by families who emigrated there about 160 years ago. They are looked upon with contempt by true believers as only half Mussulmans. The aborigines are described as very wild people—black men with long matted hair, who shun the society of mankind, and wear clothes made of the bark of a tree. The stuff is called “luff,” and is the fibre of a plant called “toka chigha,” which grows plentifully all over the sandy wastes bordering on the marshes of Lop.

Regarding the present condition of the ancient cities of Lop and Katak, I will here give an extract from the Report of the Yarkand Mission. It is the statement of a Kirghiz of Kakshal, who had travelled over Ila and Kansuh during nearly thirty years, and was in Peking at the time that city was taken by the allied French and English armies in 1860. He had resided as a shepherd for three years at Lop itself. He says (page 46): “There are, besides, two other countries of the Kalmak also called Kok Nor. One is five days’ journey north of Orúmchí, and the other is beyond Lop, five days south of Kúchá. This last is continuous with Cháchan on the east of Khutan, and in it are the ruins of several ancient cities, of which nobody knows anything. The principal of these is called Kok Nor. ‘Kok Nor’ means ‘blue lake,’ and these several countries are so called because they have such sheets of water in different parts of their surface. But these ruins of Kok Nor I myself have seen. They are on the Desert to the east of the Katak ruins, and three days’ journey from Lop in a south-west direction, along the course of the Khotan River. The walls are seen rising above the reeds in which the city is concealed. I have not been inside the city, but I have seen its walls distinctly from the sandy ridges in the vicinity. I was afraid to go amongst the ruins because of the bogs around and the venomous insects and snakes in the reed. I was camped about them for several days with a party of Lop shepherds, who were here pasturing their cattle. Besides, it is a notorious fact that people who do go among the ruins almost always die, because they cannot resist the temptation to steal the gold and precious things stored there. You may doubt it, but everybody here knows what I say is true, and there are hundreds of Kalmaks

who have gone to the temple in the midst of these ruins to worship the god there. There is a temple in the centre of the ruins, and in it is the figure of a man. It is of the natural size; the features are those of a Kalmak, and the whole figure is of a bright yellow colour. Ranged on shelves all round the figure are precious stones and pearls of great size and brilliancy, and innumerable yámbes or ingots of gold and silver. Nobody has power to take away anything from here. This is all well known to the people of Lop. And they tell of a Kalmak who once went to worship the god, and after finishing his salutation and adorations, secreted two yámbes of gold in his fob and went away. He had not gone very far when he was overpowered by a deep sleep, and lay down on the roadside to have it out. On awakening he discovered that his stolen treasure was gone, though the fob of his debil, or frock, was as he had closed it. So he went back to the temple to get others, but, to his astonishment, found the very two he had taken returned to the exact spot from which he had removed them. He was so frightened, that he prostrated himself before the god, and, confessing his fault, begged forgiveness. The figure looked benignly on him, and smiled; and he heard a voice warn him against such sacrilege in future. He returned to Lop and kept his story a secret for a long time, till a Lamma discovered and exposed him, and he was so ashamed that he left the country."

Now, to come to the manner in which the shifting sands of the Desert have overwhelmed cities and fertile country, I may give my own experience. When I was in Yarkand, in November, 1873, I saw black bricks of tea, old and musty, exposed for sale in the bazaar, and was told that they had come from Khotan. This stimulated my curiosity, and I made inquiry of our friend the Dadkhwah Mahamad Yunus and of our escort, who professed ignorance, alleging that they were almost as strange to the country as the English were to India in the early days of the East India Company. Still, the subject was not lost sight of; and one day, as we were riding over the desert country between Yarkand and Yungi Hissar, I was told that, at a distance of two days' journey, there was a very ancient city buried in the Great Desert. On arriving at Kashghar I endeavoured, but without success (of which more hereafter), to visit Khotan. I received permission, however, to visit the Kum Shahedan, or Oordum Padshah, shrine of the martyrs; and when spending a rather dreary month of expectation at Yungi Hissar, whilst the party I had despatched to Wakhan were occupied in their most interesting exploration, Dr. Bellew and I determined to make a little voyage of discovery on our own account.



Riding for three hours in a north-east direction from the Fort of Yungi Hissar, through a well-cultivated country, to the village of Saigoon, we suddenly were plunged into an arm of the Great Desert. Our route then lay over hilly ground and wide plains. Here and there we saw small wells, covered over with huts to protect them from sand-storms. The water in all was very brackish. At one well there was a tank and kind of hospice, where the man in charge, following the usual custom, came out with a large loaf of black bread on a trencher and offered us tea. At 5 P.M., after a ride of 35 miles, we came to the shrine of Huzrat Begum, the wife of Hussan Boghra Khan, who was killed and buried here just after the defeat of her husband's army, in the middle of the eleventh century. Here we found a regular hospice, with an inner courtyard, and four or five rooms for the better class of pilgrims. Outside were numerous rooms, in a spacious courtyard for common folk, and a separate cluster of houses for the servants of the shrine. The shaikh, or head of the establishment, is Shah Muksood, an old man of eighty-seven, very hale and jovial-looking. He said he had never been beyond the nearest village in his life, and therefore could never have tasted a drop of sweet water. We learned that there was a buried city, or more probably only a fort, not far off, which belonged to Tokta Rashid, an Uighur chief, and had been destroyed by Arslan Khan more than 800 years ago. Starting next morning with spades and pickaxes, we determined to see what remains of former civilisation could be dug up; and, after a weary search, found broken pieces of pottery, bits of copper, broken glass and china, and two coins, one of which is partly decipherable, and appears to belong to an early period. The discovery of glass is remarkable, as scarcely any is used nowadays there, and the art of making it seems to be unknown in Kashghar.

We then rode in a northerly direction to Oordum Padshah. At first the road slopes down to a wide hollow, which drains to the south-east, and there rises up the ridge which we had crossed the day before higher up to the north-west. On the way to this, we passed a number of shallow wells and superficial cisterns on the sides of the road. In all the water was so brackish that most of our Indian cattle refused to drink it. "From the top of the ridge of clay and gravel, which here forms a high and broad bank"—I am quoting the description given by my *compagnon de voyage*, Dr. Bellew—"we got a good view of the Desert away to the east, for the ridge soon breaks up and subsides in that direction to the level of the plain. The plain in that direction presents a vast undulating surface, drained by shallow and very wide water-runs,

in which is a thin growth of reeds and rough bushes, but no sign of running water. But to the north it presents a perfect sea of loose sand, advancing in regular wave-lines from north-west to south-east. The sand-dunes are mostly from 10 to 20 feet high, but some are seen like little hills, full 100 feet high, and in some spots higher. They cover the plain, of which the hard clay is seen between their rows, with numberless chains of two or three or more together in a line, and follow in successive rows one behind the other, just like the marks left by wave-ripples on a sandy beach, only on a large scale. Towards the south-east these sand-dunes all present a steep bank in the shape of a crescent, the horns of which slope forwards and downwards in points to the ground. The horns start from the high central part of the body of the crescent, which, in the opposite direction, tails off in a long slant down to the plain. These dunes cover the whole country towards the north and north-west as far as the eye can reach; but towards the east they cease at 4 or 5 miles to the right of our road, and beyond that distance is seen the undulating surface of the Desert.

“From the ridge up to the shrine itself, and next day for some miles further, our path wound amongst and over these sand-dunes. At about 4 miles from the ridge we passed a deserted post-stage, half submerged under the advancing sands. One of the priests of Mazar Hazrat Begum, who was with us as a guide, told us it was called Langar Bulghar Akhund, and said that it was built eighty years ago on an, at that time, open space in the sands, but had been abandoned since thirty years, owing to the encroaching sands having swallowed up its court and risen over its roof. We got down to examine the place, and found the woodwork, and fire-places, and shelves in two rooms, and also a part of the roof in a perfectly fresh and well-preserved state, as if but just vacated. About half the building was buried under a dune, the sand of which stood above the rest of it to a height of 6 or 8 feet; and on each side in rear were much larger dunes, whose regular crescentic form was perfect, and uninjured by any obstruction. At one side of the two rooms still uncovered, and which faced to the south-east, was another room filled to the door with sand, which seemed to have crushed in the roof.

“At Oordum Padshah, where we halted a day, we found some tenements actually occupied whilst in course of submergence; showing that the process is usually a very gradual one, until the symmetry of the dune is so broken by the obstructing object that its loose materials subside by a sudden dissolution of its component particles, and thus overwhelm the obstruction. In this particular

instance a chain of three crescentic dunes side by side had advanced in a line across the plain, till one of the outer crescents had struck the walls of the court of the tenement, and, growing up, had in time overtopped, and then overflowed and filled its area by its downfall; whilst the other two crescents at its side, continuing their unobstructed course, maintained their proper form uninjured. The same cause which propelled them gradually forward, also operated to drive the remainder of the broken dune forward, and it would in course of time not only bury the whole tenement, but would ultimately pass beyond it, and resume its original form on the open space farther on, in line with the other two crescents of the chain; thus leaving the tenement more or less uncovered, till it was again submerged by the next following row of similar sand-dunes.

“These sand-dunes are formed by the action of the periodical north and north-west winds, which here blow over the plain persistently during the spring months. And the reason of their progress is this—that once formed, the wind drives forward the loose particles on its surface, so that those on the sides, where there is least resistance, project forwards in the form of long horns, whilst those in the centre ride over each other till they produce the high curved bank between them; and on being propelled still farther, they topple over the bank out of the influence of the wind, but subject still to that of their gravity, which carries them down the steep slope till they reach the ground. And this action continued for a length of time is the cause of the gradual and symmetrical advance of the dunes. The rate of their progress it is impossible to determine, as it depends entirely on the varying force of the propelling power, the slope of the land, and the obstructions on its surface. But the phenomenon as we saw it actually in course of operation explains the manner in which the cities of Lop, and Katāk, and others of this territory, have become overwhelmed in a flood of sand. And it confirms the veracity of the statements made by the shepherds who roam the deserts, to the effect that in these old ruined sites the houses now and then appear for awhile from under the sand, and again for awhile disappear under it. The idea that the process of burial is very gradual, is suggested by the remarks made by Mirza Haidar, and of the probability of this we had a remarkable illustration in the tenement mentioned above, as still occupied at Oordum Padshah, though the court up to its verandah was already full of sand from the dune which had broken over its walls. Had the court in this case been on the opposite side, and the house been the first to pass under the

advancing sand, as we saw at the Langhar Bulghar Akhund, it is easy to perceive how, on toppling over the front walls (if it did not suddenly by its weight crush in the roof) it would shut up the inmates in a living tomb.

“That this actually did occur at Katak in many instances is evidenced by the skeletons and desiccated bodies which are still occasionally seen in unearthed houses, with their apparel and furniture intact and uninjured, as is told with such apparent truth by the shepherds who roam that spot at the present day. The shrine of Oordum Padshah is itself buried in the sand, and poles tufted with yaks’ tails mark the spot of the grave. But the monastery, and some almshouses around, are built on small clear spaces on the plain, which appear here and there amongst the heaps of sand, and form as it were lanes, running in the direction of the march of the sand-dunes. Some of the larger dunes, at the distance of 300 or 400 yards off, lie obliquely upon the monastery; but as they seem to advance here at a very slow rate—twelve years having passed since the dune broke into the court of the tenement mentioned without having yet completely filled its area, which is only 10 or 12 paces wide—the confident faith of the venerable sheikh who presides over it may prove justified. ‘The blessed shrine has survived the vicissitudes of eight centuries,’ he said, in reply to our forebodings of the danger threatening its existence; ‘and, please God, it will survive to the end of the world.’”

I was very anxious after this to visit Khotan and examine the ruins which have been exposed to view, but was unable to carry out my project. I, however, sent one of the Pundits, of whom so much has been heard, to travel in that direction, and I employed other trustworthy men to visit the locality. The verbal reports they brought back, each independent of the other, confirmed all I had heard before.

The inquiries of the Pundit referred chiefly to the routes through Khotan to India, and, unfortunately, he did not direct his attention particularly to these cities. But he brought me two figures, which were found in the buried city near Kiria, the one being an image of Buddha, and the other a clay figure of Hunooman, the monkey-god. These had only just been found, and it was fortunate that they soon fell into his hands, for the pious zeal of a Mahomedan iconoclast would have consigned them to speedy destruction. Another man, Ram Chund, whom I had deputed to visit Khotan, brought me some gold finger-rings and nose-rings, such as are worn in the present day by Hindoo women: also some coins, of

which the most remarkable are an iron one,\* apparently of Hermaeus, the last Greek king of Bactria in the first century B.C., and several gold coins of the reign of Constans II., and Pogonatus, Justinus, Antimachus, and Theodosius. According to Ram Chund, the buried cities proper are at a distance many marches east of Khotan; a discovery of buried ruins has, however, lately been made quite close to Ilchi, the chief city of Khotan, at a distance of 4 miles to the north-west. A cultivator, working in the fields, was watering his crop, and found the water disappear in a hole which absorbed it entirely. On digging to examine the hole, he found a gold ornament representing the figure of a cow. News of this reached the ears of the Governor of Khotan, who ordered excavations to be made, and gold ornaments and coins were found. In the month of April, 1874, about the time when Ram Chund was there, a gold ornament weighing about 16 lbs. was found. It was in the shape of a small vase, and had a chain attached to it. Rumour declared it to be a neck-ornament of the great Afrasiab, and the finder was declared to have hit upon the spot where Afrasiab's treasure was buried. This, of course, is all pure conjecture, and Afrasiab, who was father-in-law to Cambyses II., occupies in all Central Asian legends the place taken by Alexander the Great in Asiatic legendary history, or King Arthur in English tales. I hope the time is not far distant when a complete exploration of these interesting ruins will bring to light many more treasures; and it is not only in the neighbourhood of Khotan that these inquiries have to be made.

According to information we picked up from travellers, and confirmed by Syad Yakub Khan, there is a ruined city called Tukht-i-Turan, close to the city of Kuchar, on a hill of bare rock; the ruins are of earth of a deep yellow colour, quite unlike anything on the hill; there are besides a large number of caves, excavated for residence. The city is said to have existed previous to the first Chinese occupation, and to have been consumed by fire owing to the refusal of its ruler to adopt the Mahommedan faith. About 16 tash, or 60 miles, to the north of Kuchar a large idol is said to exist, which is cut out of the rock. It is 40 to 50 feet high, has 10 heads and 70 hands, and is carved with the tongue outside the mouth. The mountain behind the idol is exceedingly difficult of

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\* Probably the iron coin of Hermaeus may prove to be the oldest, but it has not yet been completely deciphered. The Antimachus is about 140 B.C. and the Menander 126 B.C. The little figure of Buddha is pronounced by competent authorities to be about the 10th century, so that the submergence of this city in the sand may be dated about 800 years ago.

ascent; game abounds, but, owing to the protection of the idol, cannot be killed. Some very remarkable ruins are said to exist not far from Mural Bashi. Syad Yakub Khan gave us a description of them, but unfortunately not till after Captain Biddulph had visited the vicinity without being aware of the prize almost in his grasp.

Not far from the present city of Kashghar is the Kohna Shahr, or old city, which was destroyed many centuries ago, yet the walls, though only built of sun-dried bricks, are standing, with the holes in which the rafters were inserted as clearly defined as if they had been only just used. They reminded me of the holes to be seen in the rocks on the Danube just before approaching the Iron Gates. As all, or nearly so, of the edifices in Central Asia are built of sun-dried bricks, it may seem remarkable that such structures should survive through so many ages, but the extreme dryness of the climate accounts for this. When I was staying at Yungi Hissar, I visited the tomb of Hussan Boghra Khan. It is recounted on his tomb how he had earned the crown of martyrdom by falling in battle against the infidel King of Khotan, whose fort, which stood close by, he had destroyed. I went to see the fort, and found not only part of the woodwork in good order, but even the matting which is put under the earthwork of the eaves of the roof was still visible. According to the date on the tomb, this fort must have been destroyed upwards of 800 years ago.

An interesting question may now be asked: Where do these sands come from? It is a remarkable fact, well supported by the evidence of our senses, as well as by the reports of the inhabitants of the country, that all these sand-hills move in one direction, *i.e.* from north-west to south-east. If I were speaking of a tract of country east of the Great Desert of Gobi, the answer of course would be plain; but I am speaking of the extreme west corner of the Desert, and, moreover, I will endeavour to describe a still more remarkable circumstance. As we left Kum Shahidan on our return journey we took a westerly direction, and after crossing a sea of sand-hills for some miles came to cultivated ground, which we again exchanged for sand. Judging from what we saw, our theory was that these sands are all gradually moving on, and the parts we saw cultivated will in time be overwhelmed, and other parts now covered will be laid bare. But, following this course for some miles, we should have come to the Tian Shan Range. Does all this sand come from that range? One idea started was that the sand comes from the great deserts in Russian Siberia, over the Tian Shan Mountains. Another idea is that it is raised in the

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Desert of Gobi, and is carried by a current of air round the basin of Kashgharia.

The idea of the sand coming from the range which immediately bounds the Desert cannot be maintained, I think. For the sand is blown always in one direction, and the particles are very much heavier than the very fine impalpable dust which fills the atmosphere with a haze as dense as a London fog, and which is doubtless raised by the various gusts of wind from the mountains on all sides. The dusty haze falls all over the land, but is not sufficiently thick to bury buildings.

The theory that the sand is brought from a desert in Russia is also, I think, untenable. It would have to pass over Issyk Kul and other lakes and cultivated land, which we know are not thus covered with sand. It would, in fact, have to mount high in the heavens, like a flock of geese, till it crossed the lofty Alai or Tian Shan Mountains, and then alight on the Desert of Gobi, sand being thus attracted to sand.

The third theory, of a circular current of air, seems more probable. I have seen, on a small scale, something of the same appearance on the elevated plateau, crossing from the Chang-chen-mo Valley to the head of the Karakash River, on the large soda or alkali plain, which is, in fact, the dried-up bed of an old lake, and is surrounded by low hills. When I was encamped in a ravine, about 5 miles from this plain, I observed about 2 p.m. that a dense cloud of white mist rose from the plain. A local dust-storm of a very disagreeable character seemed to be going on. But it did not spread, and next morning when we crossed the soda plain all was quiet. Towards afternoon, however, a storm, similar to what we had witnessed the day previously, came on, and I believe such storms are of daily occurrence, except perhaps in winter. Some of my party, in crossing the plain, came across the remains of the animals and some camp articles, too, partially buried, which, it was said, had been lost or left by Adolphe Schlagintweit in 1857. Now, what I saw there on a small scale may be going on, on a much grander scale, in the large basin of the Desert of Gobi. I may mention here that, in crossing from San Francisco to New York, I observed that the plateau between the Nevada Range and Rocky Mountains is very similar in its features to parts of Central Asia, and especially to the high regions between the Karakorum and Yarkand.

I have said that an attempt made by me to pay a visit to Khotan was unsuccessful, and this leads me to notice the remarks of a writer in the July number of the 'Quarterly Review,' who

gives his opinion that had the surveillance and restraint to which, under the guise of attentions, the Mission was subjected been resisted successfully at the beginning, and had not time been unaccountably lost, a much more extensive exploration of this interesting country might have been made. This able reviewer had probably not travelled in Asiatic countries, or he may have forgotten his knowledge of Asiatic character, and has not weighed sufficiently carefully the responsibilities which fetter those who have the conduct of such an expedition as I had the honour to command. But as the opinions he has thus expressed have been shared by others, who, with an imperfect knowledge of the whole circumstances of our position, have chafed at the loss of apparently easy opportunities for adding to our stock of knowledge, I may here say a few words which will perhaps throw some light on the matter, and explain what the reviewer considers to be unaccountable negligence on my part. However friendly an Asiatic may be, he is proverbially suspicious of the actions of all foreigners. Mr. Shaw, to whom, as the Quarterly Reviewer justly remarks, is due the honour of the first successful advance into that long closed country, as is duly related in his 'High Tartary, Yarkand, and Kashghar,' an interesting record of his adventures and of difficulties overcome by a happy mixture of boldness and diplomacy with patience and good humour, gives instances of the disappointments to which he was subjected, and he has often recounted to me the manner in which he was tantalised with expectations of immediate liberty of action, but always to be disappointed at the moment of fruition. During his first visit to Yarkand and Kashghar he was kept a prisoner inside the four walls of his house or in his tent, and never entered the city at all. This was, however, a circumstance in no way to be wondered at; but when he revisited the country as the Political Agent deputed by the Indian Government, and after the return of our Mission, when he might be sure of enjoying the fruit of newly established relations with the Ameer, I fully expected that he would travel about the country and accomplish what we had left undone. But it is a fact that Mr. Shaw did not even enter the city of Kashghar, although he resided for several months within a few miles of the city. He has never been inside it or beyond Yungi Shahr, the old Chinese quarter now occupied by the Ameer, and 5 miles distant from the city. The reason he gave me for this was that though he doubtless might have insisted on going there, he abstained from doing so out of deference to the known or supposed feelings of the Ameer: and if in such a small matter he considered it polite to abstain from exercising an

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Englishman's propensity to satisfy his curiosity, I feel that I have a strong authority on my side. To anyone unacquainted with the character of these Asiatics, their conduct is often inexplicable, and most trying to one's patience. Mr. Shaw recounts how the Yarkand officials would come to him in his confinement and propose a visit to the city, or to some gardens in the neighbourhood, and having excited his expectation to the highest pitch, and having gone so far as to fix the time for going and all preliminaries, they would raise some hidden and insuperable objection. I found exactly the same process adopted with reference to myself. On the occasion of my first visit to Yarkand, in 1870, the Dadkhwah made the usual offer of perfect liberty of action, but was mightily offended because I took him at his word. On the second visit, I arranged through my friend Syad Yakub Khan for complete liberty to be accorded to the members of the Mission to roam about anywhere within a day's journey of our quarters, leaving more extended excursions to be matter of separate arrangement. We had not been lodged in Kashghar a week before we obtained the permission of the Ameer to visit the frontier fort of Chakmah. Captain Biddulph was allowed to go on an excursion to Maralbashi, and as soon as the weather permitted we took a journey up towards Ush Turfan. During the winter months very extended journeys could not be undertaken; but I was consequently consulted as to my wishes for sending a party to Aksu and to Lake Lop, as well as to Khotan. The Ameer volunteered to make use of Dr. Stolzka's valuable scientific knowledge, and after having received his report, or specimens of coal, copper, and other ores, proposed that he should be sent to examine the mines. But, as in Mr. Shaw's case so it was in ours; just at the last moment some excuse was raised, and the expedition had to be postponed *sine die*. I find that another great traveller (M. Prejevalsky) details experience similar to ours, and complains of being detained just at the moment of departure, for reasons which he could not discover either then or afterwards, and Schuyler, in his most interesting work on 'Turkestan' records similar experiences, and I am inclined to think that all European travellers in Central Asia are likely to suffer in the same way until they can discover the secret which the reviewer apparently possesses for overcoming these obstacles. The important journey to the Pamir by Colonel Gordon's party required considerable negotiation on my part; and after it had started, the Ameer sent word to recall it, and I had some difficulty in reconciling the Ameer to Colonel Gordon prosecuting his journey. My application to visit Khotan, after having

been sanctioned and every arrangement having been made, was, finally, flatly refused; and had I insisted on having my own way, it is most probable that I should have found insuperable difficulties put in my path, and it is certain that I should have caused a breach in the friendship it was my object and duty to cement.

Possibly it may be said that all this only shows the hollowness of the Ameer's performance of friendship; and, in fact, I have frequently seen this urged as a proof of the worthlessness of any treaty of amity with the rulers of countries across our border. But I take leave to differ entirely from such opinions. We cannot judge Asiatics as we would Europeans. They do not understand expeditions conducted for purely scientific purposes; and they may be excused for disliking to show all their resources even to their most valued European friends. I cannot do better than conclude my Paper by a quotation from the remarks made by the distinguished President of the Royal Geographical Society:—"We must complain that our reputation in the East takes its complexion from our conquests and progress in India, the history of which, in broad outline, at least, is perfectly well known in China, if not all over Asia. How we began by asking for a privilege for trade, and ended by annexing provinces, after disastrous wars, is no secret. Whatever explanations or defence we may have to offer as to the causes of this inevitable advance from trading factories to Empire, we can scarcely expect any Eastern sovereign or people to attach much credit to them. We must be content to trade and to negotiate, weighted with the heavy burden of distrust and suspicion.

Mr. H. H. Howorth said, as he was at present engaged in writing the second volume of 'The History of the Mongols,' he had been brought into immediate contact with the very interesting problems connected with the history and topography of the districts to which Sir Douglas Forsyth had referred, and which it was well known formed one portion of the great Mongol Khanate of Jagatai Khan. Those districts were more surrounded with romance to ethnologists than any other portion of the earth's surface. Lake Issikul he believed was the focus of the home-land of the Turks, and all their early traditions centred around its borders. A great number of students also regarded the country to the south as the home-land of the Aryan races. Whether this was so or not, the district was the frontier separating the Turanians from the Aryans at the present moment, and in olden times undoubtedly it was occupied by an Aryan race. He had lately returned from St. Petersburg, where he met the great Chinese scholar, Professor Wasilief, who frequently spoke to him about this region, and said that, after a great deal of patient research, he was quite convinced that whatever civilisation there was in China was originally derived from the Aryans; and if so, it must have been from Aryans who occupied this particular district. It was therefore extremely interesting to find there, remains which pointed to the presence of a race which certainly all the Chinese accounts which had

been translated by Rémusat and others seemed to show were Aryans. He therefore looked with the greatest possible interest and pleasure to the time when some of these remains would be accessible to the examination of scholars. The traditions of the people in the district seemed to point to some of the remains being of the period of Arslan Khan. He supposed that meant that they belonged to the dynasty of the so-called Kara-Khanids, all of whose kings were styled Arslan Khan, or Lion Khan. Professor Grigoief had written a very interesting paper on this subject, in which he had thrown considerable light on the old chiefs who reigned at Kashghar from the ninth to the eleventh century. The Russian authorities connect these princes with the Karluk Turks. One fact, which was new and rather startling to him, in the Paper was the evidence of the presence of Buddhism in the district so early as the beginning of the Christian era. Professor Lerch of St. Petersburg, who had written an admirable topographical paper on the Jaxartes, had told him that he had found a Buddhist tomb of perhaps the sixth century in the country to the west of Uzkand, while the earlier of the Chinese Buddhist pilgrims who passed this way carry us back to the fifth century. But the presence of Bactrian and Indo-Scythic coins in this district, with Buddhist statuettes, carries back the story much further. In connection with these buried cities which Sir Douglas Forsyth had described, it was impossible not to think of the destruction of the cities by sand to the west of the Oxus, on the old channel of that river. A good deal further north, in the region occupied by the Ostiaks and the Samoieds, there are also underground remains, which the people point to as the habitations of their ancestors, and which they say are constantly marked by curious sounds, as of animals travelling underneath. In an old Arabic account of the ninth century, mention is made of the presence of griffins in this district; and some years ago, in the old treasury of St. Denis, a horn was discovered which had been presented to one of the kings of France by Harun al Raschid as the horn of a griffin; but it turned out to be simply a fossil horn of a rhinoceros. In conclusion, he expressed a hope that some portion of the Society's funds and energy would be directed to the publication of other matter than mere travels, and that they would assist to make accessible more of the work that was done in Russia. No greater work could be done than a translation of the Russian edition of Ritter's 'Asia.' The collection illustrating ethnology in England might also be greatly enlarged, and made worthy of our wide commerce and interests if Geographers would remember that we have a very fine national collection, partially exhibited in the British Museum and partially at 103, Victoria Street, whose indefatigable curator was unsurpassed for knowledge in Europe. He hoped that travellers who brought home objects illustrating savage life would take them there, rather than allow them to be lost or broken in private houses.

Sir H. RAWLINSON stated that it was probable that, very shortly, some further interesting information would be obtained with regard to the district described by Sir Douglas Forsyth, as during the conference at Brussels he was assured by Baron Richthofen that Colonel Prejevalsky was on the point of leaving Kulja for Kara-shahar with the intention of proceeding direct to Lake Lob, where he expected to spend Christmas Day. In the letters which Prejevalsky had written from Kulja he announced that he was satisfied that in Lake Lob was to be found a flourishing Russian colony. He stated that he had obtained authentic information that about one hundred years ago a number of Russians escaped from Siberia, and established themselves on an island in Lake Lob. They formed a flourishing colony there, and their numbers had been augmented by other refugees. One of the great objects of his present journey would be to open up communication with those people, who possibly might be the same as those to whom Sir Douglas Forsyth had referred. He (Sir H. Rawlinson) had listened with

great interest to the paper, and cordially agreed with most of the views there advanced. He might be able to make a few verbal criticisms, but he by no means claimed to have inherited the mantle of Mr. Crawford, who had been called "The Objector General," and would only therefore take exception to the word "Katak," which he believed to be a wrong reading. He had consulted four copies of the *Tarikhi Rashidi*, and Quatremère had consulted others, and in all of these MSS. the word was Kanak. Whether the name, however, of this particular ruined site was Katak or Kanak, it was a very interesting fact that there were old buried cities in that region exhibiting marks of Indian influence. At the same time he did not think it had been sufficiently considered that the Aryan inhabitants of India came originally from the country described by Sir D. Forsyth, and were rather recent visitors to India. No doubt Khotan was one of the very earliest settlements of the Aryan race and one of their main points of civilisation. Its real name was Koustana, and it was probably pressure from the Turanian races from the north-east that drove the Aryans from Koustana down upon India, where they found an aboriginal population, neither Aryan nor Turanian, whom they gradually displaced. Therefore, when marks of Indian influence were found in Central Asia, he did not consider that such marks were derived from India, but were rather the relics of the old race who had descended upon India; for he was not aware that there had ever been any ethnic reaction from India to the northward. He would also recall Sir Douglas Forsyth's attention to the city of Pein, which Marco Polo alluded to. That place was not entirely unknown to Geography, for independently of the Chinese pilgrims of the seventh century, who described it under the name of Pi-mo, the city of Pein was also distinctly laid down in a Turkish map of Central Asia, printed in Constantinople (in the *Jehân-namâ*) about 250 or 300 years ago. He had never been able, it is true, to learn where the author had obtained his information. A Turk at Constantinople would hardly have laid down a city as a sister capital to Yarkand and Kashghar upon the authority of Marco Polo, of whose existence he could hardly have heard, yet no other Moslem Geographer had mentioned Pein. Sir Douglas Forsyth's paper was a most excellent and valuable one, and had drawn attention to a very interesting and important subject, not only as regards the Geography, but also the Ethnology of Central Asia.

COLONEL H. YULE did not consider that the identification of the remains as Hindoo necessarily proved identity of race with the inhabitants of India. It simply proved the extension of the Hindoo religion to that country at a very early date; and this former great extent of Hindoo influence was a circumstance that had struck him forcibly in listening to the present Paper. There was some reason to suppose that the cities which were destroyed near Lake Lob were also subject to the influence of Hindoo religion. The Chinese traveller Hwen-Tsang, in the seventh century, mentioned one of them under the name of *Navapa*, which appeared to be a Sanskrit name, and might easily have been modified popularly into Lob or Lop, the name given by Marco Polo to a city in this region, and mentioned by other writers. Sir Douglas Forsyth spoke as if he felt confident that the mountains to the north of India had been habitually passed in ancient times; but it was probable that the intercourse always mainly was by the circuitous but easier route across the Pamir, which had been the great pass from Western to Eastern Asia through all history. Hindoo influence was found almost as far west as the Caspian. Some of the old Arab historians or geographers stated that the name of the great city of Bokhara signified a place of instruction, and he himself had a strong impression that it was nothing but the Buddhist *Vihâra*, a monastery or temple, and that that centre of Mohammedan bigotry was, in fact, originally a settlement of Buddhist monks among

the marshes of the Zarafshan. This Hindoo influence then was found spreading to Lake Lob, and eventually to China, and west to the Caspian, and east to the Islands of the Moluccas. It had also spread, though in a commercial rather than a religious form, down the coast of Africa to about the 20th degree of south latitude. Another point that struck him in looking at the map now displayed was the prodigious progress that had been made in our knowledge of Central Asia since he first entered the service. At that time none of the country from the Surlej to the extreme north of Turkestan was decently mapped. Nearly all that appeared then in our maps of this vast tract was little better than more or less judicious conjecture, founded on literary materials that did not exclude Marco Polo, hardly even Ptolemy; with some very scanty and fragmentary aid from the Jesuit observations of last century; but at present only a small part, chiefly the central portion near the banks of the River Tarim, remained unexplored.

The PRESIDENT regretted that the lateness of the hour prevented a continuation of the discussion of so suggestive a subject. To himself the paper had been one of intense interest, both ethnographically and historically. He had long been in the habit of believing that physical laws very much governed the distribution of races, and it now appeared that the sand-dunes of Central Asia swept down from the north-west to the south-east, just as the Russians had been doing for the last two hundred years. Was there any natural law that determined this? In conclusion, he expressed the acknowledgments of the Meeting to Sir Douglas Forsyth, and the proceedings then terminated.

*Second Meeting, 27th November, 1876.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*Prof. Cavaliere Enrico H. Giglioli*; } *Hon. Correspond.*  
*Eugene Schuyler* (Secretary to the United States } *Members.*  
 Legation, Constantinople).

*John Alstone, Esq.; Thomas R. Arnott, Esq.; E. T. Atkinson, Esq.* (Indian Civil Service); *Arthur Edmund Ball, Esq.; Frederick H. Balfour, Esq.; Thomas Bell, Esq.; W. M. Bickerstaff, Esq., J.P.; A. Bowden, Esq.; William Bowman, Esq., F.R.S.; William John Chetwode Crawley, Esq., LL.B., F.G.S., &c.; Augustus Champion De Crespigny, Esq.; P. Dekeyser, Esq.; Ernest A. Floyer, Esq.; Lord Garragh; George Green, Esq.; Arthur Gunn, Esq.; Abdul Hakk Karnalkar; Narg.-Lieut. George C. Hammond, R.N.; John Hassard, Esq.; Edward Herries, Esq., C.B.; Major Bertie Hobart, R.A.; Capt. Edward O. Hollist, R.A.; Charles C. Howard, Esq.; Thomas Manson Rymer Jones, Esq., C.E.; Matthew Kane, Esq., M.D.; James Laming, Esq.; Rev. Henry Lansdell; Hon. John Hamilton Lawrence; Edwin B. Lethbridge, Esq.; Alex. Fornes Luttrell, Esq. (Lieut. Gren. Gds.); George de L. Macdona, Esq.; Robert Allan McLean, Esq.; N. H. Nuhishima, Esq.; Edwin H.*

*Newby, Esq.*; Colonel John Pigott Nixon (Consul-General and Political Agent for Turkish Arabia); Joseph Percy, Esq.; Sir Ruse Lambert Price, Bart.; Mirza Mohamed Rahun; Richard C. Rapier, Esq., C.E.; J. T. Robinson, Esq.; Harry G. Seeley, Esq., F.L.S., F.G.S., F.Z.S., &c.; Dr. Thomas Somerville, LL.D.; Capt. Leopold Victor Swaine; Staff Commander J. H. Tizard, R.N.; Henry Ulyett, Esq.; Lieut. Robert Horace Walpole, R.N.; Christopher Ward, Esq., F.L.S.; O. C. Waterfield, Esq.; J. C. Webb, Esq., M.D.

DONATIONS TO THE LIBRARY, FROM 13TH TO 27TH NOVEMBER, 1876. Notes of a Voyage in Turkey and Persia, 1848—1852, by the late General Tchirikoff, Russian Commissioner for defining the Turco-Persian Boundary, by M. Gamazoff (in Russian); St. Petersburg, 1875 (*M. Gamazoff, per Captain Clarke*). Handbuch für Reisende, Egypten, I., edited by K. Baedeker; Leipzig, 1877 (*Editor*). Report to the President of the United States, 'Polaris' Arctic Expedition (*Chief Justice Daly*). Zur barometrischen Höhenmessung, von J. Hann; Wien, 1876 (*Author*). On Prehistoric Names of Weapons, by Hyde Clarke, 1876 (*Author*). Education and Culture, by A. Mackennal; Leicester, 1876 (*Author*). Official copy, Tide-tables for 1877 (*Lords Commissioners of the Admiralty*). Gumpel's Patent Rudder. 1875 (*S. M. Drach, Esq.*). The Indignation Meetings of Liberals, and conduct of affairs in the East, 1876 (*Anon.*). Ueber die Nothwendigkeit des Waldschutzes für die schiffbaren Ströme Russlands, &c., von G. von Helmersen; St. Petersburg, 1876 (*Author*). Tableaux de population, &c., pour l'année 1874; Paris, 1876 (*The French Colonial Minister*). Ueber die Malayische Säugethier-Fauna, von A. von Pelzeln; Wien, 1876 (*Librarian*). K. Svenska Fregatten Eugénies Resa omkring Jorden, Häft. 4, 5, 9, and 12, in completion of the work so far as issued (*The R. Swedish Academy of Sciences*); and the current issue of publications of corresponding Societies, Periodicals, &c.

The PRESIDENT said the Papers on the programme for the evening meeting all related to Central Africa, a subject of increasing interest at the present time in consequence of the International Conference at Brussels. Great efforts were about to be made for the exploration and civilisation of Central Africa, and on a larger scale than had ever before been attempted. The Papers to be read all referred to the results of the Expedition of the Khedive to the region of the Nile Lakes, and in connection with this he wished to draw attention to a summary of the Geographical and Scientific results of the Khedive's recent Expeditions, which had been received by the Society, and would be published in the 'Proceedings.\*' There had been no less than twenty-seven important results and discoveries attendant on these Expeditions, and it was impossible to speak too highly of the liberal expenditure and enlightened interest with which the Khedive had provided for the purely Geographical

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\* Vide p. 63, infra.

and Scientific aspect of these undertakings. Two of the Papers to be read had been received from General Stone, the intelligent Chief of the General Staff at Cairo, and it was very gratifying to note the zeal and promptitude with which General Stone was carrying out the Khedive's orders to afford the Society the earliest possible information with regard to everything that was done by these Expeditions. Since Signor Gessi's return from his navigation of Albert Nyanza, Colonel Gordon, in July of this year, ascended to the Lake in the little steamer *The Khedive*. The world was indebted to Signor Gessi, under the direction of Colonel Gordon, for one of the most valuable discoveries in connection with the course of the Nile and the lakes that had been made of late years. While it was being disputed whether the Nile really issued from Albert Nyanza or not, Signor Gessi settled the point by sailing his boat right up the river into the lake.

Whilst on the subject of African exploration, he (the President) wished to express the deep regret with which the Society had recently heard of the death of Mr. Rebmann, one of the East African missionaries who originally called attention to the system of great lakes of Central Africa. He was sent, in the year 1846, by the Church Missionary Society to join their missionary, Dr. Krapf, in East Africa. He accompanied Dr. Krapf in most of his travels in Eastern Africa, and they together discovered the snow-covered mountains Kilimandjaro and Kenia, for which, in the year 1852, they received the Silver Medal of the French Geographical Society. In their journeys in 1851 the missionaries met with a merchant from a country to the north-east of the River Dana, who affirmed the existence of a great lake called Baringo. Various reports continued to reach the missionaries Krapf, Rebmann and Erhardt, that all travellers travelling west from different starting points along 6 degrees of the coast eventually arrived at a Bahari or inland sea. The map furnished by Erhardt and Rebmann was laid before the Royal Geographical Society, and the result was the first expedition of Captains Burton and Speke. Captain Speke, in his great work 'The Nile Sources,' says: "I must now call attention to the marked fact that the missionaries residing for many years at Mombasa are the prime and first promoters of this discovery." And he concludes with the following remarkable words: "The good that may result from their map will, I trust, prove proportionately as large and fruitful as the produce from the symbolical grain of mustard seed, and nobody knows or believes in this more fully than one of the chief promoters of this exciting investigation, Mr. Rebmann. From these late explorations he feels convinced, as he has oftentimes told me, that the first step has been taken in the right direction for the development of the commercial resources of the country, the spread of civilisation, and the extension of our geographical knowledge." Mr. Rebmann continued at his post labouring unremittingly in the reduction of three of the principal languages of Eastern Africa, until, totally blind, he returned home in 1875, rejoined his old companion Krapf in Germany, and they together were engaged in passing through the press Mr. Rebmann's 'Dictionary of the Kinyassa Language,' when, after a short illness, he died at Kornthal near Stuttgart.

The following Papers were then read:—

1. *Observations on the Nile between Dufli and Magungo.*  
By Colonel C. E. GORDON.

[Communicated by General STONE, Chief of the General Staff, Cairo.]

At the distance of about 20 miles to the south of Dufli the river begins to widen out, and the current becomes therefore less rapid;

and from that point to Magungo the river is nothing more than a portion of Lake Albert. The current is very slow, not more than half a mile per hour; the bed is wide, sometimes as much as two or three marine miles, and it is filled with islands of papyrus. The banks of the river are fringed with papyrus, and are difficult of approach. The country is very populous—much more so than any other portion of Africa that I have seen—and the natives are well disposed. They were greatly astonished at the sight of the steamboat. Banana cultivation is met with at a distance of 40 miles to the south of Dufli, and it continues on south for 20 miles, when it ceases, and is not met with again until the Lake is neared, when it reappears. I do not know the cause of the interruption in the banana cultivation. At the distance of 50 miles to the south of Dufli the natives wear each a skin, farther on they clothe themselves with the bark of a tree. I believe that, taking Ratatchambé as a centre, and describing a circle with a radius reaching to Fashoda, that circle would include all the tribes that go entirely naked—a zone outside of that circle would include those half clad—and a zone outside that would contain the tribes who fully clothe themselves.

I have not seen the branch which leaves the Nile and flows to the north-west, according to M. Gessi; having troops with me, I could not delay my voyage to make close examinations of the country, but I do not doubt of its existence. I have found Sir Samuel Baker's map quite correct for the northern portion of the Lake. The mouth of the Victoria Nile is very difficult to find, the whole coast being sown with papyrus islands: there are thousands of them, and one can hardly say where the Lake ends and where the river begins. There is no current, and the water is shallow. One can hardly conceive the number of villages (Zeribahs) which exist on the left bank of the river. In this it resembles the Shillook country in former days. The Lake has a sad and deserted appearance, and the country around is very uninteresting.

The steamboat ran very well, and from what I have seen is sufficient for the service.

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## 2. *Notes on the Victoria Nile between Magungo and Foweira.*

By Colonel C. E. GORDON.

[Communicated by General STONE, Chief of the General Staff, Cairo.]

FROM Magungo to Murchison Falls the River is navigable, and the current does not exceed one knot per hour; but from that point to the Karuma Rapids, 9 miles below Foweira, the river is full of



strong rapids. The country is almost deserted by man. The banks of the river are bordered by trees. In a word, it is a wilderness. It seems that the Nile runs through a plateau from Foweira to Murchison Falls. Then, in a space of 10 or 15 miles, it has a fall of 700 feet. The rapids near Foweira are strong, but between them the river flows tranquilly. It is within the 10 or 15 miles' space above alluded to that the waters fall most.

Nothing can describe the solitude of this deserted country. The wars between Kaba-Rega and Aufina have prevented the natives from settling in the territory thus subjected to invasions from both directions.

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3. *On the Circumnavigation of the Albert Nyanza.* By  
ROMOLO GESSI.\*

Kerri, May 5. 1876.

KNOWING the interest which the English people generally take in Central African Exploration, I am induced to lay before the Royal Geographical Society an account of the voyage I have just made round Albert Nyanza. His Excellency Colonel Gordon, Governor-General of Equatorial Africa, kindly entrusted this mission to me, and placed at my disposition two iron boats constructed by Messrs. Samuda Brothers, together with all that was necessary to the accomplishment of my mission.

I had rigged the two boats as cutters, and manned them with 18 sailors and 12 soldiers. I left Dufli on the 7th of March, 1876, and arrived at the mouth of the lake on the 18th of the same month; our slow progress being attributable to the contrary winds, the incessant rains, and the currents. My mission was to explore the part of the river between Dufli and the lake, to visit Magungo, and to go round the lake. Before proceeding to describe my voyage on the lake, it will be useful to give some details regarding the part of the Nile in question, which had never previously been explored.

From Dufli to the lake is 164 miles, and throughout the whole distance the river is navigable, deep, and broad; in certain places exceeding 700 yards. At two-thirds the distance from Dufli there is a large branch which runs in a N.N.W. direction, and probably flows towards Makraka, in the country of Niam Niam. The country is very rich; the natives are clothed in the skins of antelopes or goats; and the products of the soil are varied, consisting of millet, the wheat of the country, sesame, honey, tobacco, bananas, beans,

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\* Translated by the Assistant-Secretary of the Society.

&c. Cattle are abundant, and comfort and plenty appear to reign among the people.

We arrived at the entrance to the lake at the time of the equinox, and the stormy weather compelled us to wait. On the 20th of March, allured by the promise of a fine day, I started to traverse the north-eastern corner in the direction of Magungo; but, when we were about two-thirds across, a strong land-breeze suddenly sprung up, and prevented us from reaching the coast. All our efforts were in vain; the wind increased in violence, and we had to run before it, under double-reefed sails, trying all we could to keep the shores in view and discover some convenient anchoring-place. We saw a sandy beach which might have answered our purpose; but it was occupied by a party of disbanded soldiers of Kaba Rega, who had come with the intention of attacking us. Their threatening attitude obliged us to continue our course; but the natives kept pace with us along the beach, hoping that sooner or later our vessels would be driven ashore. After much difficulty, we managed to escape from these troublesome neighbours, and anchored in a harbour having the form of a horse-shoe. The foul weather continued during the night, and at midnight the wind became so strong that one of our boats dragged its anchor, the bottom being of loose sand, and ended by being driven ashore at about three in the morning, and becoming filled with water and sand. The greater part of our provisions was thus destroyed, as well as our instruments. Our position became difficult, for we were still in the neighbourhood of the hostile troops. With the materials that the water had cast on the beach we constructed a small barricade, with only one weak point to be afraid of. Two Dutch pieces, No. 2, loaded with grapeshot, were placed in position, and we then waited for the termination of the storm in order to commence repairing damages. Towards morning the wind calmed down, and with it the heavy sea subsided. Nailing a sail round the boat, we commenced to bale out the water and sand, and, assisted by both boats' crews and the soldiers, we succeeded in raising the vessel and resuming our voyage in the direction of Magungo. On the 30th of March we reached our destination; but the hostility of the natives compelled me to proceed up the Victoria Nile in search of some village belonging to Aufina's Government. Near Murchison Falls I found a Chief subject to the (Egyptian) Government, who undertook to carry my message to Aufina, where the commander of our troops would be found. Ten days afterwards the troops arrived, and I gave them their orders. On the 12th of April I was again *en route*.

*Extracts from my Journal.*

*April 12th.*—At 4 A.M. we arrived near the first islets, which lie 5 to 7 miles distant from the shore: they are sand-banks, on which there is some vegetation, and they afford good shelter to vessels against all winds. At the time when I reached them they were full of natives, who had resorted here to escape the pursuit of the troops.

*13th.*—Continued our route as far as the last of the islets. The mainland of the lake is low, the shores sandy, and the interior rich in vegetation and timber. We passed a cataract, then a second, and after that a third. There was a village, and I was able to obtain of the inhabitants the following information:—The first cataract is called Huima; the second, Wahambia; and the third, Nanza. They proceed from a large river, which is never dry, and which is called Tisa. I have no doubt this is the River Kaiigiri of Sir Samuel Baker. The natives declare that, although they have been very far into the interior of Uganda for ivory, they have never reached the source of this river.

*15th and 16th.*—Continued our course, and at 8 P.M. experienced a strong wind from the east, which increased in violence towards 10 P.M. We reefed sail, and about 2 A.M. secured our boats in a snug harbour, which I have named Port Schubra. It contained many villages, and I am certain that it is the Vacovia of Sir S. Baker; but the name has disappeared, other tribes having driven out the former occupants. This port is 250 yards wide and 600 or 700 in length. The shores of the mainland form cliffs descending to the water.

*17th.*—I remained all day in this port, baling the water from our boats, and drying our linen. We had been for thirty-six hours exposed to incessant rain.

*18th.*—Resumed our voyage. The wind was favourable. After a course of some 40 miles, I noticed in the distance islands and vegetation. The water had changed its colour and become whitish; from the mast-head it had a reddish hue, and, on casting the lead, the depth proved to be only 12 feet, with muddy bottom. I have no longer any doubt that we are near a river. After continuing 10 miles further, we entered the river, and ascending it 7 miles, were stopped by the growth of papyrus and other aquatic vegetation. From the heights a large waterfall leaped down, much grander than the three we had already passed. The river came to an end in this *cul de sac*. The natives had fled from the village which we found close at hand; nevertheless, I was unwilling to quit the

place without trying every means of obtaining accurate information. After we had been waiting some hours, the sailors called me to look at a hippopotamus which was just emerging from the water to enter the thickets. A shot from one of Reilly's rifles, No. 8, brought it down, the ball having pierced its forehead, and effectually stopped it from taking another step.

Three of the natives slowly approached us, although the report of our gun had created some alarm at the commencement. I told them they might help themselves to some of the hippopotamus meat. They began with a will, and cut slices of the meat with their lances; others followed them, and, in a short time, more than fifty of them had reduced the animal to a skeleton. After giving them *suksuk*, and gaining their confidence to some degree, I was able to obtain the following information, viz., that the waterfall came from waters which accumulate in the mountains, and form a river during the season of the rains, but dry up, together with the river, in the dry season.

They asked me where I was going, and having told them I was going to the end of the lake, they replied, "You are already at the end of the lake: you cannot get beyond the ambatch, for the water is only so deep," showing me the height of their knees. I told them I wanted to see the river that there was at the end of the lake. They assured me there was no river at the end of the lake: and when I retorted that there must, at any rate, be a waterfall, they said there was not: there was no river or fall, yonder or elsewhere, at the end of the lake, except the one before us. A storm arose, and we returned on board just in time to get up the anchor and run clear of a floating island, which came towards us with incredible velocity. This country is called Quando, and the inhabitants are suspected of cannibalism.

19th.—We cleared out of the river, and endeavoured to force a passage through the ambatch, but all to no purpose, the ambatch-growth being very dense, and the water, as the natives had told me, very shallow. We continued, in this way, to navigate along the ambatch, the boat's keel touching the bottom from time to time. The water everywhere had a black colour, owing to the forests of ambatch, and it was undrinkable; there was no current whatever, and the bottom was sandy. Keeping thus to the border of the ambatch-fields, we crossed the lake from east to west, a distance of 40 miles, without finding any passage. From the mast of the boat I observed that the forest of ambatch extended very far, and that beyond it there succeeded a field or

valley of herbs and vegetation which reaches to the foot of the mountains.

We now found ourselves on the opposite shore and wished to obtain information at a village which lay before us: but the inhabitants carried off their property. The Nogararas called together their warriors, and made hostile demonstrations. I waited until they had finished their military evolutions, hoping that some one would then approach; but they were very hostile, and we could not get near them with our boats. It was now dark, and we retired a little from the shore.

20th.—The next day I again approached the shore, but saw none of the natives. The sound of their drum had not ceased all the night. I sent a man up the mast to see if no one was coming to meet us. The man reported that they were close at hand, concealed by hundreds in the bushes. It was an ambuscade. Half an hour afterwards five natives came to tell us that the chief was waiting for us; that he had prepared meat and merissa; and that we were all to land. I thanked them, saying we had no desire to land; but only wanted them to show us the way to the end of the lake. Their reply to all our speeches was, "Come, come to the Chief." I left the place; and, after an hour's sailing, reached another large village. Although the inhabitants here also fled to the hills with their household goods, they showed no hostility, and some of them came so near that our interpreter was able to make himself heard. I asked them to send the Chief to speak with me. In the course of half an hour an old man of some sixty years came and sat down on the beach; and having made him a liberal present of glass beads and copper wire, I put the following questions to him:—

Q. "I want to reach the end of the lake; please show me a place where I can find a passage?" A. "You cannot get beyond the ambatch; there is no water."—Q. "How much water is there as far as you can reach among the ambatch?" He showed me his pipe, to indicate the depth—about 15 inches.—Q. "There is a river entering at the end of the lake, which I wish to see." A. "There is not any river at the end, nor anywhere else in this neighbourhood; but there is one yonder," showing us the opposite shore, which we had recently left.—Q. "But there is certainly a waterfall?"—A. "No, there is no waterfall; but, if you go further on, you will meet with three falls."—Q. "Where do these three falls come from?"—A. "From a river formed by the waters of the rains."—Q. "Is the water permanent?"—A. "No; when the

Harif ceases, the river and falls cease also.”—Q. “What is the name of this river?”—A. “I have never heard that it has a name.”—Q. “What is there at the end of the lake, where the ambatch terminates?”—A. “Sand and bushes. The water ends in the middle of the ambatch; there is very little water there.”—Q. “Do the waters remain here always at the same level, or do they rise during the heavy rains?”—A. “They remain almost always the same; if they rise, it is very little or none at all.”

All my efforts were without result, and the last information I received agreed perfectly with what I had been told on the eastern side. The stagnant and blackish water, the sandy bottom, the total absence of current, the shallow depth, all proved that there was no river at the end of the lake. From Vacovia to the end of the lake, also on the western side, the mountains descend vertically to the water, and are destitute of large timber, being clothed with bushes only. I can say nothing about the interior, as I was not able to undertake a land journey with so small an escort, nor could I leave the boats without protection. Nothing further being practicable, I prepared for our return, and we directed our prows towards the north.

Favoured by the wind, we passed the three falls which the old Chief had told us of. During the night the wind increased in violence, and at midnight it blew a hurricane. At 3 A.M. our position became critical. Violent gusts of wind succeeded each other from different quarters all round the compass; and the waves surging tumultuously on all sides, we expected every moment to founder. We lightened the fore part by removing every article, even the anchor and cable, and all the men were employed in baling out the water. It was a night of agony. There was not a single harbour or sheltering-place all along the coast, and we were driven 40 miles out of our course. At last the wind became more favourable and towards five o'clock in the evening we came in sight of M'Caroly.

I did not notice any currents during my voyage, except that with strong south-west winds the water drifted towards the north-east, and with north-east winds towards the south-west. I remarked that there was a line on the face of the rocks about 4 inches above the present water-level; but I am not able to say if this line marks the limit of highest water in the lake, the natives having on all sides assured me that the waters neither rose nor fell.

In conclusion, I may remark that those only who visit Albert

Nyanza during the rainy season can form any idea of the immense amount of the rainfall in this region. Any further information that you may require I shall be happy to supply.

I have, &c.,

ROMOLO GESSI,

Attaché to the General Staff of Gordon Pacha.

Length of the Lake, 141 miles; greatest width, 60 miles.

#### 4. *The Khedive's Expedition to the Lake Districts.*

By Colonel C. E. GORDON.

[Communicated by the Rev. E. J. DAVIS.]

Alexandria.

As so much interest has been taken in the different expeditions to the sources of the Nile, I give a summary of what Colonel Gordon's expedition has effected.

Colonel Gordon started from Cairo on the 23rd February, 1874, and reached Gondokoro on the 16th April, 1874. Finding that his government consisted of the three military stations, Gondokoro, Fatiko, and Foweira, that the troops were in want of many things, and in arrears of pay, he determined to return to Khartoum to obtain more troops, and to meet his stores. Having done so, he started with the same on the 8th June, 1875, and arriving at the Sobat junction with the Nile, he sent his staff on, and remained at the Sobat to form a station there, and to supervise the evacuation of two slave establishments on Bahr Zaraffe. Owing to heavy rains and delays, he did not arrive at Gondokoro till September, 1874. It was then seen that Gondokoro was unfitted for a station, owing to want of wood for fuel for the steamers, and from the want of Dhurra, which the natives there did not cultivate. It was decided therefore to evacuate it, and to establish two stations, Lardo and Rageef, one 12 miles below, and the other about the same distance above, Gondokoro. This evacuation was not completed till the 1st January, 1875, when Colonel Gordon descended and made an inspection of the stations, Bohr and the Sobat, returning to Lardo on the 4th March. The remainder of the month of March was spent in the subjugation of Bedden and other hostile Sheikhs near Rageef; and now had to be faced the great difficulty, viz., how to establish a safe communication between the Lake Districts and Lardo.

Taking it roughly at 120 miles, the intervening country was one

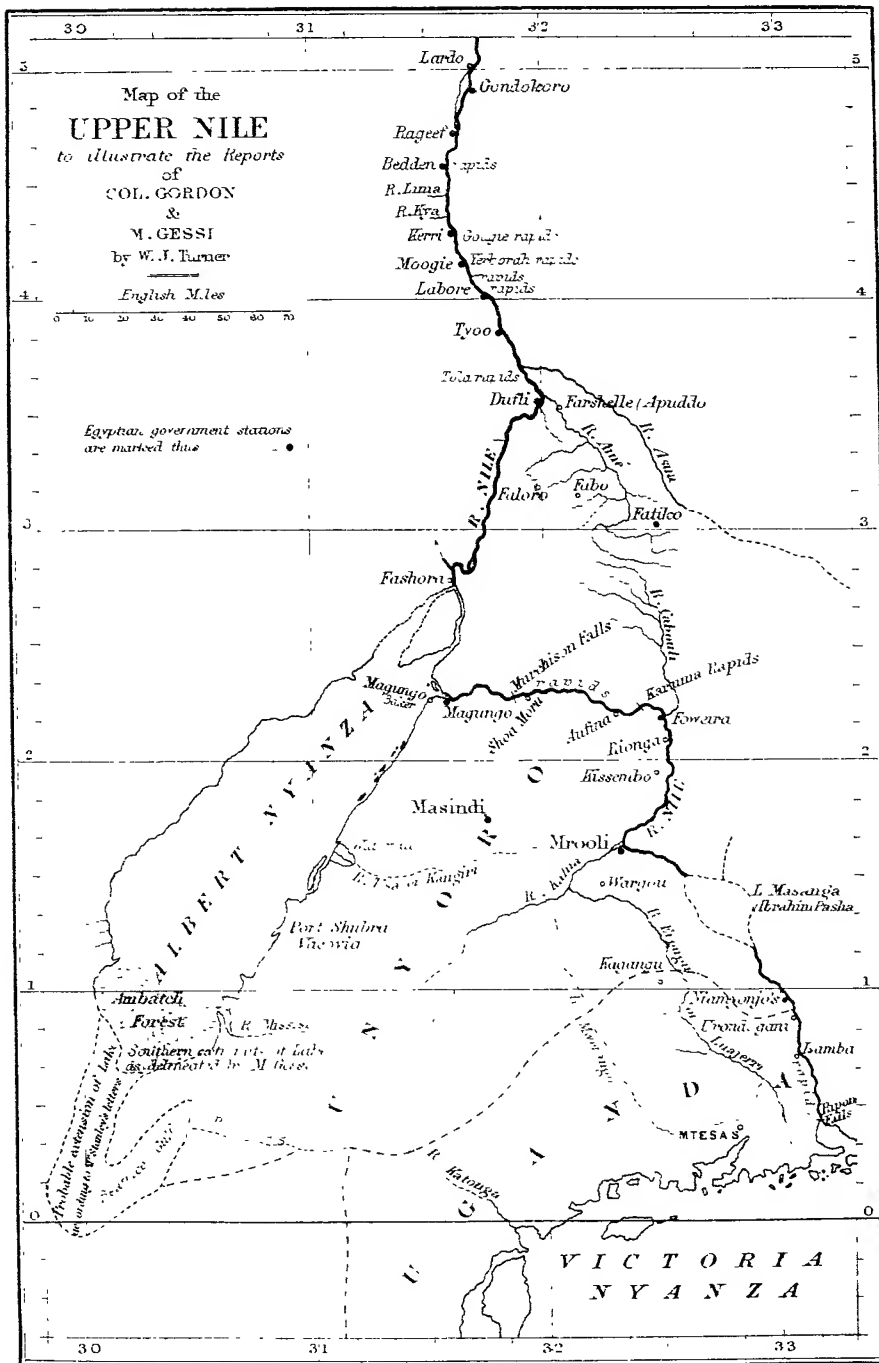
to illustrate the Reports  
of  
COL. GORDON  
&  
M. GESSI  
by W. J. Turner

by W. J. Turner

*English Males*

A horizontal number line with arrows at both ends. It has major tick marks labeled 0, 10, 20, 30, 40, 50, 60, and 70. A small vertical tick mark is drawn at the position of 10.

Egyptian government stations  
are marked thus - ●



W. & A. K. Johnston.





devoid of supplies, unless taken from the natives by force; in the rainy season the numerous streams were torrents, while in the dry season little water could be obtained. The natives were friendly or hostile, according to your force, but may be generally said to be hostile. A reconnaissance having shown the Nile to be navigable considerably farther south than was supposed, it was determined to establish the line of posts to preserve the communications between the north and south of the province, along the left bank of the Nile, and not to attempt the usual inland road. Keeping to the Nile prevented attacks being made on the stations from more than one side, and secured, at all seasons, a supply of water. Troops were pushed up from Rageef to Bedden Rapids and Kerri, but at Moogie the natives became very hostile, and caused much delay, so that it was not till October, 1875, that the chain of posts was completed from Lardo to Dufli, a station established by Mr. Kemp in September, 1874, nearly opposite Baker's Apuddo. A miserable sort of warfare had to be conducted against several of the tribes with little or no bloodshed, if we except the unfortunate affair in which Mons. Linant lost his life. The river was found navigable as far as Kerri; thence to the Asua it was possible to take up vessels, but difficult, however, from the Asua junction with the Nile. The river for 10 miles was found quite impracticable; thus this 10 miles is the only obstacle to a vessel of 60 to 80 tons ascending from the Mediterranean to the Lake Albert.

By the 1st January, 1876, the whole of the sections of the 50-ft. steamer and two iron life-boats had arrived at Dufli, and their construction commenced, while troops were massed at Foweira for an advance south, towards Victoria Lake.

By the end of April, 1876, the Lake Albert had been circumnavigated by M. Gessi, who found it much of the size it was supposed to be by Captain Speke, with no river of importance entering it; a branch from the Nile, soon after its exit from Lake Albert, flowing to north-west was discovered; where it flows to is not yet known. The stations at Keroto, Mrooli, and Magungo, were formed, and at the end of July the 10-horse-power steamer was completed, and made her first voyage from Dufli to Magungo, at the entrance of Victoria Nile.

There now remains the placing of a steamer on Victoria Nile to ply between Foweira, Mrooli, and Urondogani. From Urondogani, or rather Isamba, to Lake Victoria the Nile is not navigable, so another steamer will have to be placed on Lake Victoria, which will complete the extension of Egyptian territory.

Between Urondogani and Mrooli there is a Lake Masanga, from

which a branch flows to the north-west and which may flow into the River Asua or River Sobat.

Mtesa's independence has been respected; and there is every reason to believe Kaba Rega will come to terms and accept the half of his kingdom, Rionga and Aufina occupying the other two quarters of his State.

We may therefore consider the Nile to be known along its whole course, with the exception of the branches flowing north-west from the Nile after its exit from Lake Albert, and that flowing from Lake Masanga, half-way between Mrooli and Urongani.

The country generally is quiet and the roads secure. The inflow of ivory continues good; and the expenses of the occupation are fully covered by the revenue, which may be put down roughly at 60,000*l.* a year.

Letters from England reach the most southern parts of the Province in little over two months.

The future of the Province will depend much on the amelioration of the route from Cairo to Khartoum, and on the enterprise of private merchants who hitherto have been discouraged from venturing up on account of the insecurity of the routes, which, however, are now safe.

Mr. HYNDMAN rose to thank the Council for giving him, through the kindly intervention of Colonel Yule, an opportunity of placing before the Society a matter which seemed to him to have an important bearing on the future of African exploration—namely, the behaviour of Mr. H. M. Stanley towards the natives. He had no intention of moving a resolution on the subject; all he wished to do was to read a few sentences from Mr. Stanley's own letters, and then to ask the Society, as the leading Geographical Society in the world, whether it ought not to express its opinion upon them. Mr. Hyndman then read some extracts from Mr. Stanley's letters which had appeared in the 'Daily Telegraph' relating to that gentleman's treatment of the natives.

Colonel YULE said he felt constrained to say a few words on this subject, because he had been the means of bringing Mr. Hyndman forward on the present occasion. Whatever technical reasons there had been for stopping the motion which Mr. Hyndman had proposed to bring forward at the previous meeting (and these he by no means disputed), there were far stronger reasons why Mr. Hyndman should not be "shut up," as many members had considered that gentleman to have been. He did not think there were any serious differences of opinion with regard to Mr. Stanley's proceedings, and he had met with no one who had not condemned them. The Society owed Mr. Stanley a great debt for his discovery of Dr. Livingstone; and that, as well as his absence from England, was a reason for not dwelling upon the details of his narrative. Still, they could not do him any very great injustice if they judged of the character of his acts by his own letters. Mr. Hyndman had been very persistent in his conduct of this question, because he was very much in earnest; though his speech this evening had shown that he was anything but a factious person, who wished to get up an agitation in the Society. He (Colonel Yule) did not agree with the proposal to pass a formal resolution. The Society had not sanctioned Mr. Stanley's proceedings by any formal resolution, and

therefore he did not see why they should condemn them by such a resolution. He, however, thought utterance should be given in a meeting of the Society to a condemnation of Mr. Stanley's acts; for twelve months ago a meeting of the Society was devoted to the glorification of Mr. Stanley, and what the newspapers called an "ovation" was given to that gentleman. He did not think that on that occasion the Fellows had thoroughly digested the letters; and even Mr. Hyndman said nothing then. Next day, however, he wrote to the 'Pall Mall Gazette' on the subject, and commenced that course of remonstrance, which he had since so consistently followed out. "Ovation," he believed, was etymologically connected with *ovis*, a sheep; and when people got upon lines of excessive glorification, they were very apt to follow one another like a flock of sheep, and not see all the puddles they came across. Taking Mr. Stanley's own narrative, how were the natives to distinguish between such a body of roving foreigners, armed with such desperate weapons, and the slave-gangs that Livingstone died to suppress, except that Mr. Stanley's canoes on the Victoria Nyanza must have seemed to them to have devils on board far more terrible than the Arab slavers? How would the next Speke or Livingstone (if it were possible to look for another Livingstone!) fare upon the Lake? It was just such proceedings of their countrymen or supposed countrymen, that brought those two illustrious men, John Coleridge Patteson and James Goodenough, to a cruel end. He felt sure there would have been a more hearty expression of sympathy with Mr. Hyndman, if it had not been that his words were regarded as an attack upon somebody. But at whom could Mr. Hyndman be supposed to aim a blow? Surely, not at the late President, Sir H. Rawlinson, who was the man of all others whose name shed honour upon the Society, and to whom he (Colonel Yule) owed one of the greatest honours of his life—the gold medal of the Society. It should not be *his* hand, at least, that would be lent to such an attack. At whom, then, was the blow aimed? It must be at the Society as a whole, and by them all it ought to be answered. They had all shared in giving Mr. Stanley an ovation; let them all share in expressing condemnation of his acts, as narrated in his last letters.

Sir H. RAWLINSON said he simply rose to ask the meeting to consider what was the use of raising this question. The Society was not established for the discussion of such subjects, which did not involve any principles of practical geography. If Mr. Stanley had been one of the Society's agents, he could quite understand any Fellow calling upon them to denounce him; but Mr. Stanley was not a member of the Society; he was not even an Englishman. His connection with them simply was that he had received their gold medal for services performed, and no one could question that those services were great, and that the Society was quite justified in according him the medal. His own position with regard to this question was rather remarkable. Two years ago he was criticised in the columns of 'The Times' for not giving Mr. Stanley sufficient credit; but now he was supposed to be too much in his favour. The real fact was that he did not look at Mr. Stanley's moral qualities or personal character, but solely upon his geographical services, and when he succoured Livingstone he certainly was entitled to reward. Last year, when the news of the circumnavigation of the Victoria Nyanza arrived, he (Sir Henry) was also glad to help in giving Mr. Stanley an "ovation." But giving "ovations" was not the province of the Society; their business was the furtherance of geographical research, and any person who contributed to that was entitled to their warm approbation. He had no hesitation in saying that he did not approve of Mr. Stanley's deeds, as recorded by himself; but that was no reason why the Society, in its collective capacity, should pass any vote of censure or pronounce any general condemnation.

Sir BARTLE FRERE thought it was as well now to take the course generally known as reverting to the previous question, and rest content with what had already been said. Mr. Stanley was at the present moment engaged in exploration, and therefore should not be judged harshly. They should recollect that they had only a hasty letter, written in the midst of difficulties; and without for one moment saying that Mr. Hyndman had done wrong in bringing forward the subject, he thought they might pass to the previous question. That question was the exploration of Africa. The King of the Belgians had proposed, at the International Congress, at Brussels, a united effort by the nations of Europe to open up Africa to civilisation. His suggestion was that each country should determine on a particular route to the interior, and devote its energies to opening it up. It was well known how costly it was to carry on geographical explorations, and nothing but the great expense deterred commercial men from going to clothe those tribes who, we had just been told, were either entirely naked, or simply wore skins of beasts and the bark of trees. There were rich, well-watered countries in Africa; and a continued repetition of such expeditions as that of Cameron would open to the producing countries of Europe a vast amount of commerce. He had had the pleasure of explaining the King of the Belgians' plan to the people of Glasgow, who had a deep feeling of pride in their countrymen—Mungo Park, Bruce, and Livingstone; and many of them volunteered to undertake the support of the scheme. Mr. James Young and Mr. Wright were, with Mr. Stevenson and Mr. Mackinnon, foremost in the work; and he hoped that when the President laid before the public the details of the plan, London would make haste and work very hard if they did not wish to be beaten by Glasgow. This scheme would not be antagonistic to any of the work that the Society had hitherto undertaken in Africa. The International Society would be a sort of Executive Exploration Society, undertaking to do, once and for ever, what was now separately done by individual effort. The Glasgow people had appropriated to themselves the great route from the eastern coast to the north of the Lake Nyassa. Upon that lake, which Livingstone pointed out as the centre of the slave-trade in that part of the world, two Scotch missions had already established themselves. They had a steam launch upon its waters; and they were resolved, if possible, to carry on the line of exploration to Lake Tanganyika. Cameron had pointed out that, from Alexandria to the mouth of the Zambesi, there were only a few hundred miles separating the navigable rivers and lakes, and that with short portages, such as might easily be established, it was quite within the power of Englishmen of the present day to have a continuous communication from the Zambesi to the mouth of the Nile. He trusted that the King of the Belgians' scheme would not be allowed to drop through by the Royal Geographical Society.

Mr. E. HUTCHINSON (Secretary of the Church Missionary Society) said that he had long felt convinced of the importance of improving the means of access to the interior in order to suppress the Slave-trade and develop the resources of the country, and that it would be desirable to select for improvement the line between the coast near Zanzibar and the great centres Unyamwebe and Ujiji. Those who had read the works of Speke, Grant and Stanley would remember the importance which those travellers attached to the River Wami as a highway to the interior, and accordingly, when Sir Bartle Frere was in Zanzibar, the Church Missionary Society wrote to him asking him to have that river surveyed, and Sir Bartle Frere had a portion of it surveyed. Since then the Missionary Society had sent out a steam launch, and the river had been explored, but he was sorry to say that their anticipations had not been realised, for it was found to be thoroughly unsuited to anything like a water-way; for, after a journey of 65 miles, the exploring

party were only 15 miles from the coast. The river Kingani had been tried with a similar result, and the idea of water communication was therefore abandoned. A station had, however, been established at Mpwapwa, on the first range of hills about 200 miles from the coast, and information had since been obtained which encourages the belief that a practicable road might be made between Mpwapwa and Saadani or Bagamoyo with no great difficulty. The London Missionary Society were working side by side with the Church Missionary Society in endeavouring to open up the interior, and the land had been apportioned out between the two Societies, the Church Missionary Society taking the Victoria and Albert Nyanza, and the London Missionary Society taking Tanganyika as their field. While the Church Missionary Society were trying their plan of water communication, the London Missionary Society were trying the old-fashioned bullock-waggon, and Mr. Roger Price, the agent of the latter Society, had discovered that the dreaded tsetse-fly was not to be found in a route running from Saadani to the north of the Wami up to the highlands of Mpwapwa. The road was not quite so smooth as it might be, but Mr. Price had furnished full information as to its character, and the Church Missionary Society had sent all the details out to their agents at Mpwapwa, with instructions to do all that could be done to make the route practicable for bullock-waggons. One part, therefore, of what the King of the Belgians had been contemplating the Missionary Societies were doing, and a practicable road was about being made to Mpwapwa. Once there the waggons would come upon the great rolling plateau which runs right away to Unyanyembe. On that plateau the Victoria Nyanza was situated, and Colonel Grant had said that, if the waggons were once placed on the plateau, he did not see why they should not get along as easily as at the Cape of Good Hope. The Church Missionary Society had asked the Government to aid the Sultan of Zanzibar, who was perfectly honest and sincere in his efforts to help them, to protect the road when made. Such a road would cut the neck of the Slave-trade. With regard to the plan adopted by the Scotch Committee of extending a road from the north of Lake Nyassa to Lake Tanganyika, he was inclined to fear, from the information furnished by Livingstone, and also from Jacob Wainwright's journal of his march with Livingstone's body from Bangweolo, that access between Nyassa and Tanganyika would not be a very easy matter. He sympathised with what had been said as to the result of Mr. Stanley's operations on the Victoria Nyanza; but he did not think the details which had been referred to by Col. Yule were before the Fellows when they gave the "ovation" to Mr. Stanley. The moment the Church Missionary Society heard of them, they telegraphed to Dr. Kirk, begging him to tell their agents that Stanley had met with the most determined hostility on the south of the lake; and they had been glad to learn that that information had reached the party, and would probably influence them to a certain extent in the route they selected. If everything went well, it was hoped that by next June there would be a steam launch upon Victoria Nyanza.

Mr. J. FOWLER, C.E., said he had had no personal experience of any part of Equatorial Africa south of Wady Halfa. His professional duties in Upper Egypt and Nubia, and in places further south and west, had been to improve the transport communication in the Nile valley, partly by the construction of a short railway at Assuan, to overcome the obstruction of the First Cataract, and partly by a cheap railway south of Wady Halfa, where the navigation of the river was impossible. He had, however, under the direction of His Highness the Khedive, made careful surveys, with levels, into Darfur, as far as its capital, El Facher, and through Kordofan to Khartoum by various routes. So soon as the details were completed, he would have the greatest possible pleasure in placing the information he had obtained at the disposal of the Society.

Sir H. RAWLINSON observed that the discussion had very much departed from the actual subject of the Papers, which was Colonel Gordon's proceedings on the Upper Nile. Colonel Gordon had rendered great assistance to African exploration. The information which had been obtained from him and his subordinates was of the utmost value. If the arm of the Nile which had been discovered striking out from the well-known course of the river to the north-west proved to be navigable, it would be of great importance to the future development of the interior of the Continent. In the same way, if the arm leaving Lake Ibrahim really joined the Sobat, it would avoid the impediments of the Karuma Rapids and the Murchison Falls. Colonel Gordon was now returning to England. He had done his work well, and had suffered severely in health and spirits. At the time he (Sir H. Rawlinson) last heard from him, Signor Gessi was the only European still remaining with him—all the rest having died or been invalided; so that he was left with only Egyptian officers, on whom, of course, he could not depend as upon European officers. Although ovations were strictly not part of the duties of the Society, they must sometimes fall into temptations of that kind, and if any man was ever entitled to an ovation, Colonel Gordon would be, on his return. It should be remembered that this was "Chinese Gordon," and no one could be more thoroughly conscientious, more unselfish, and more energetic in his work.

The PRESIDENT said it was quite true, as Sir H. Rawlinson had remarked, that the meeting had not specially directed their attention to the interesting geographical questions dealt with in the Papers which had been read, and to the great service which the Khedive and Colonel Gordon had rendered, not only to the cause of Geography but to the cause of humanity in general, in opening up a communication from the Mediterranean to the Albert Nyanza and the Victoria Nyanza. He cordially sympathised with what Sir H. Rawlinson had said about Colonel Gordon. He had the pleasure of knowing him in China, where he proved himself a Christian soldier, a brave general, and a most able and skilful man, who could combine and form into an army the roughest and rawest of Chinese recruits, and lead them to victory. He did not think there was any exaggeration in saying he saved the Chinese Empire, or, at all events, the reigning dynasty there, for without his great knowledge and skill and influence over men, it would not have been possible for China to have emerged from the state of chaos and revolution into which it was plunged by the Taipings. Still, when Colonel Yule thought there was a disposition to "shut up" people who had any legitimate feeling to give expression to, he was not sorry that the discussion had taken the turn it had, and in consequence had somewhat passed over the great services which Colonel Gordon had performed in Africa. It could not now be said that there was any desire on the part of the Council to "shut up" any legitimate expression of opinion on the part of the Fellows. He did not believe that there were two shades of feeling with regard to the conflicts of Mr. Stanley with the natives of Africa, and he thought Lord Derby had expressed the feeling of the whole nation when he said that Mr. Stanley's later letters were read with great regret, and that they created a most painful impression throughout the country. But it should be remembered at the same time that he had rendered great service in finding Livingstone,—that he was one of the boldest and most successful of explorers, and that he was now travelling in hourly peril, carrying his life in his hand, amid hostile tribes full of cruelty and treachery, and even if they only intended to rob him, yet robbery in those parts meant depriving him of the means of existence or of return to the coast. He was assailed with overwhelming numbers in the first conflict that he had described, and if he were now present he might probably be able to defend himself against the charge of having caused greater loss of life than was absolutely necessary for his preservation, and to give better

reasons for what he had done than appeared in the hurried and sensational letters which had reached England. The Society was bound to remember his past services, and that he was now travelling, not for gain, but simply to win the reputation of being one of the most successful travellers who had ever entered the interior of Africa. The Society had no control over him; he was not even an Englishman, though he carried the English flag (and that was a subject of regret to many), and therefore the Society had no right collectively to censure him. No doubt there was a unanimous feeling with regard to his proceedings, and all condemned in the very strongest way the circumstances, so far as they were known, of apparently ruthless slaughter and violence, which he had described in the second attack on the island of Bambiré, but they could not do so as a Society. Sir Bartle Frere had drawn attention to the present crisis in African Exploration. So much had been done of late years that it seemed as if the two oceans, east and west, and the Mediterranean, were about to be united, and a line of communication formed which would open up Central Africa to commerce and civilisation, and put an end to the most atrocious slave-trade that ever existed. The International Society would not sanction, either directly or remotely, any unnecessary violence or bloodshed; but even in civilised countries, if brigands or pirates attempted to rob and murder, a man was allowed, by the law of self-preservation, to defend himself by every means in his power, and in Africa, where there was no law, force must be met by force. He did not think it possible to carry out the most philanthropic measures there without occasional hostile collisions with the natives, and in such cases where there was no law such force as was necessary in self-defence must be exercised. Sir Bartle Frere had said all that it was necessary to say as to the great and disinterested aims of the International Congress held at Brussels, and he hoped that the Royal Geographical Society, while remaining uncommitted to any line of action, would take the most cordial interest in all proceedings which had for their object the opening up of Africa to commerce, the suppression of a most flagitious slave-trade, and the spread of the truths of the Gospel and of civilisation throughout Africa.

The following is the "Summary" referred to by the President, in his opening remarks, p. 47.

*Summary of Geographical and Scientific Results accomplished by Expeditions made by the Government of the Khedive of Egypt during the three years 1874-5-6.*

War Office.  
Bureau of the General Staff, Cairo.  
16th October, 1876.

1st. Accurate reconnaissance of the White Nile, from Gondokoro to Lake Albert.

(Gordon, assisted by Watson, Chippendall, and Gessi.\*)

2nd. Reconnaissance of the White Nile between Khartum and Gondokoro, with greater exactitude than had ever before been accomplished; with the determination of five positions by means of astronomical observations.

(Watson and Chippendall, under the orders of Colonel Gordon.†)

\* 'Proceedings' R. G. S., vol. xix., pp. 324, 455; vol. xx. pp. 12, 67, 443, 470; vol. xxi. pp. 15, 48 et seq.

† To be published in the 'Journal' R. G. S., with Map. vol. xlv.



3rd. Observations of the Planet Venus, December, 1874, by Watson and Chippendall, under the orders of Colonel Gordon, at Rageef, near Gondokoro.

4th. Reconnaissance of Lake Albert, 1876, by Gessi, under the orders of General Gordon.\*

5th. Establishment of steam-navigation on Lake Albert, by General Gordon.

6th. Verification of the course of the Nile between Lake Victoria and M'rooli, and the discovery of Lake Ibrahim, by Lieutenant-Colonel Long, under the orders of General Gordon.†

7th. Verification of the course of the Nile between the Falls of Karuma and Lake Albert, by Linant, Gessi, and Piaggia, under the orders of General Gordon.‡

8th. Discovery of the branch flowing from Lake Ibrahim, in a northerly direction, by Piaggia, under the orders of General Gordon.

9th. Discovery of the branch flowing from the Nile, near Lake Albert, towards the north-west, by Gessi, under the orders of General Gordon.§

10th. The accurate reconnaissance of the Nile between Foweira and M'rooli, by General Gordon.

11th. Reconnaissance of the country between the White Nile, near Gondokoro and Makraka, in the Niam-Niam country, by Colonel Long (assisted by Marno), under the orders of General Gordon.

12th. Reconnaissance and completion of the Map of the route between Debbé and Matovi, and between Debbé and Obeiyad, by Colonel Colston, assisted by five officers of the Egyptian Staff.

Report of the northern portion of the Province of Kordofan—Colonel Colston.

13th. General reconnaissance of the Province of Kordofan, and completion of the Map to the 12th degree of north latitude, by Major Prout, assisted by five officers of the Egyptian Staff. Lines of reconnaissance traversed about 6000 kilometres, and 17 positions determined astronomically. General Report upon the said Province by Major Prout.

14th. Botanical reconnaissance (with large collection of plants) of the Province of Kordofan, by Dr. Pfund, under the orders of Colonel Colston and Major Prout.

15th. Botanical reconnaissance (with collection of plants) of the central portion of the Province of Darfur, by Dr. Pfund, under the orders of Colonel Purdy.

\* 'Proceedings' R. G. S., vol. xxi. p. 50.

† Ib., vol. xxi. p. 49.

‡ Ib., vol. xx. p. 107.

§ Ib., vol. xxi. p. 50.

16th. Reconnaissance of the route between Dongola, upon the Nile, and El Facher, the capital of Darfur, by Colonel Purdy, assisted by Lieutenant-Colonel Mason and five other officers of the Egyptian Staff.

17th. General reconnaissance of the entire country of Darfur, and a portion of the Dar Fertit, as far as Hofrat el Nahass and Shekka to the south, as far as Gebel Medob to the north, and as far as the frontier of Wadai to the west; with the completion of the Map and general Report upon the country. By Colonel Purdy, assisted by Lieutenant-Colonel Mason, Major Prout, and nine other officers of the Egyptian Staff. Distance traversed, over 6500 kilomètres. Twenty-two positions determined astronomically.\*

18th. Geological and mineralogical reconnaissance of the country between Rudesieh and Kinnah, upon the Nile, and the Red Sea, near Cosire; with a Geological Map and profile, and Report. By Mr. Mitchell, assisted by an officer of the Staff, and Emiliano; with large collection of specimens.

19th. Topographical and geological reconnaissance of the country to the south-west of Zeylah and near Tajurra, by Mr. Mitchell, assisted by an officer of the Staff, and Emiliano. Preparation of the Map. Collection of geological specimens.

20th. Reconnaissance and completion of the Map between Zeylah and Harrar, Map of the city of Harrar and neighbouring country, by Major Mocktar, of the Staff, assisted by Adjutant-Major Fouzy, of the Staff attached to the Expedition of Raouf Pacha.

21st. Topographical reconnaissance of the country between the coast of the Red Sea, near Massowah, and the Abyssinian plateau; with the completion of the Map. By Colonels Lockett and Field-Lieutenant-Colonels Derrick and Balig. Majors Dulier, Demison, and Dürholz, Captain Irgem, and several other officers of the Egyptian Staff.

22nd. Geological reconnaissance of the country between Massowah and the Abyssinian plateau; with collections of specimens. By Mr. Mitchell, assisted by Emiliano.

23rd. Reconnaissance and survey of the country between Berberah and Gebel Dobar; with completion of the Map. By Captain Abd-el-Rarock Hasmy and other officers of the Egyptian Staff.

24th. Reconnaissance and sounding, with completion of Map, of the Ports of Kismaya and Durnford, upon the coast of the Indian Ocean, by Colonel Ward, assisted by Captain Sidky and other Staff officers.

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\* A copy of the Observations is deposited in the Library of the Royal Geographical Society.

25th. Reconnaissance between Tajurra and Aussa, by the Staff-Lieutenant Mohammed Izzat, under the orders of Munzinger Pacha.

26th. Reconnaissance of the town and completion of the Map between Siout (by the Desert) and Ain-el-Aghiéh, by Major Dürholz, assisted by an officer of the Egyptian Staff.

27th. Barometrical and thermometrical register taken by officers in the Province of the Equator, Kordofan, Darfur, and during all the Expedition.

## ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Address delivered on the opening of the Geographical Section, at the Glasgow Meeting of the British Association, September 7th, 1876.*  
By Captain F. J. O. EVANS, C.B., F.R.S., Hydrographer to the Admiralty ; PRESIDENT of the Section.

Two events, notable in the annals of Geographical Science have to be recorded since the last meeting of the British Association : and these events as bearing materially on the advancement of our knowledge of geography are deserving the special commendation of this Section. I refer to the successful issue of Cameron's land journey across the tropical regions of Southern Africa and to the successful completion of the sea voyage of the *Challenger* ; a voyage which in its scope included the circumnavigation of the globe, the traversing the several oceans between the 50th parallel of North latitude and the Antarctic circle, and the exploration throughout, by the medium of the sounding-line and dredge, of the contour features, the formation, and the animal life of the great oceanic bed.

The general results of the notable African land journey have already, through our Parent Society in London, been brought largely under public review ; and at our present meeting many details of interest will be placed before you by the intrepid traveller himself. The courage, perseverance and patient attention to the records of this long travel have been dwelt on by our highest geographical authorities, and so far it might appear superfluous to join in praise from this chair ; nevertheless, it is to that part of the proceedings of Cameron, the unvarying attention and care he bestowed on instrumental observations, in order to give those proceedings a secure scientific basis, to which I would direct your attention as being of a high order of merit.

With this example before us, remembering the country and climate in which such unremitting labours were carried out ; distinction to the future explorer cannot rest on the mere rendering of estimated topographical details, but can alone be fully merited when those details are verified by instrumental observations of an order sufficient to place numerically before geographers the physical features and characteristics of the explored region.

Turning now from the results of the land journey of Cameron to those of the sea voyage of the *Challenger*, we are again reminded of the value of repeated and methodically arranged instrumental observations in geographical

research. With our present knowledge of the sea-board regions of the globe, little remains, except in Polar areas, for the navigator to do in the field of discovery, or even of exploration, otherwise than in those details rendered necessary by the requirements of trade or special industries. It is to the development of the scientific features of geography that the attention of voyagers requires to be now mainly directed; and in this there is an illimitable field. The great advance in this direction resulting from the two leading events of the past year, to which I have referred, foreshadows geographical research of the future.

Communications of special value from some of those voyagers whose good fortune it was to leave and return to their native land in the ship *Challenger* will doubtless be made to this and other Sections.

I trust, nevertheless, as one officially interested in the Expedition from its inception, and as having in early days been engaged in kindred work, and also, as I hope, without being considered to have trespassed on the scientific territories of these gentlemen—ground indeed so well earned—this Meeting will view with indulgence my having selected as the leading theme of my address to it, a review of that branch of our science now commonly known as the “Physical Geography of the Sea;” combined with such suggestive matter as has presented itself to me whilst engaged in following up the proceedings of this remarkable voyage.

It has been well observed that “contact with the ocean has unquestionably exercised a beneficial influence on the cultivation of the intellect and formation of the character of many nations, on the multiplication of those bonds which should unite the whole human race, on the first knowledge of the true form of the earth and on the pursuit of astronomy and of all the mathematical and physical sciences.” The subject is thus not an ignoble one, and further, it appears to me appropriate: assembled as we are in the commercial metropolis of Scotland, from among whose citizens some of the most valuable scientific investigations bearing on the art of navigation have proceeded.

As a prefatory remark, I would observe that the distinctive appellation “Physical Geography of the Sea” is due to the accomplished geographer Humboldt; it is somewhat indefinite though comprehensive, and implies that branches of science not strictly pertaining to geography, as commonly understood, are invaded; but this intrusion or overlapping of scientific boundaries is inevitable with the expansion of knowledge: and it is difficult to see how the term can be wisely amended, or how the several included branches of physics can be separated from pure geographical science.

We are indebted in our generation to the genius and untiring energy of Maury, aided originally by the liberal support of his Government, for placing before us, in the twofold interests of science and commerce, an abundant store of observed facts in this field; accompanied too by those broad generalisations which, written with a ready pen and the fervour of an enthusiast, gifted with a poetic temperament, have charmed so many readers, and in their practical bearings have undoubtedly advanced navigation in practice.

In our admiration, however, of modern progress, we must not in justice pass by without recognition the labours of earlier workers in the same field. So early as the middle of the seventeenth century we find in Holland, Barnard Vanerius describing with commendable accuracy the direction of the greater currents of the Atlantic Ocean and their dependence on prevailing winds; the unequal saltness of the sea, the diversity of temperature, as the causes of the direction of the winds, and also speculating on the depths of the sea. Vanerius's geographical writings were highly appreciated by Newton, and editions were prepared at Cambridge under the supervision of that great man in 1672 and 1681.

To Dampier the seaman and Halley the philosopher we owe graphic de-

scriptions of the trade-winds as derived from personal experience ; while the investigation by Hadley of their causes, and the conclusions he arrived at, that they were due to the combined effects of the diurnal revolution of the earth on its axis, and the unequal distribution of heat over different parts of the earth's surface, in substance still remains unchallenged.

To Rennell we owe a masterly investigation of the currents of the Atlantic Ocean—an investigation which, for precision and a thorough conception of the conditions affecting the subject, will long serve as a model for imitation. His period covered some thirty or forty years during the end of the last and the beginning of the present century. At that epoch, chronometers—though very efficient—had scarcely passed the stage of trial, but had nevertheless commended themselves to the first navigators of the day ; whose aim it was to narrowly watch and test this, to them, marvellous acquisition. Rennell thus commanded nautical observations of a high order of merit, these he individually verified, both for determining the ship's position absolutely and relatively to the course pursued ; and our knowledge of surface-currents was established on the secure basis of differential results obtained at short intervals such as a day or parts of a day, instead of the previous rude estimation from a ship's reckoning extending over a whole voyage, or its greater part.

At a later date we have, by Redfield, Reed, Thom, and others, solidly practical investigations of the gyration, and at the same time bodily, progressive movements of those fierce and violent storms which, generated in tropical zones, traverse extensive districts of the ocean, not unfrequently devastating the narrow belt of land comprised in their track ; and on the sea baffling all the care and skill of the seaman to preserve his ship scatheless ; while the clear and elegant exposition by Dove of their law, and its application as one common general principle to the ordinary movements of the atmosphere, must commend itself as one of the achievements of modern science.

While, for the moment, in the aerial regions, we must not forget the industry and scientific penetration of the present excellent Secretary of the Scottish Meteorological Society. His more recent development of the several areas of barometric pressure, both oceanic and continental, bids fair to amend and enlarge our conceptions of the circulation of both the aerial and liquid coverings of our planet.

Looking then from our immediate stand-point on the extent of our knowledge, as confirmed by observational facts of the several branches of physics pertaining to the geography of the sea, just rapidly reviewed ; we find that, resulting from the methodical gathering up of "ocean statistics" by our own and other maritime nations, in the manner shadowed forth by Maury and stamped by the Brussels Conference of 1853, we are in possession of a goodly array of broad but nevertheless sound results. The average seasonal limits of the trade-winds and monsoons, with the areas traversed by circular storms are known ; also the general linear direction and varying rates of motion of the several ocean currents and streams ; together with the diffused values of air and sea-surface temperatures, the areas of uniform barometric pressure, and the prevalent winds, over the navigable parts of the globe.

Thus far the practical advantages that have accrued to the art of navigation, —and so directly aiding commerce—by the gradual diffusion of this knowledge through the medium of graphical rendering on charts and concise textual descriptions cannot be over-rated—still much is wanting in fulness and precision of detail, especially in those distant but limited regions more recently opened out by expanding trade. Science views, too, with increasing interest these advances in our knowledge of ocean physics, as bearing materially on the grand economy of nature ; essays, brilliant and almost exhaustive

on some of its subjects, have been given to us by eminent men of our own day; but here one is reminded, by the diversity in the rendering of facts, how much remains to be done in their correlation, and what an extensive and still expanding field is before us.

The dawning efforts of science to pass beyond the immediate practical requirements of the navigator are worthy of note. We find—from an admirable paper “On the Temperatures of the Sea at different Depths,” by Mr. Prestwich, just published in the *Philosophical Transactions*—that in the middle of last century the subject of deep-sea temperatures first began to attract attention, and thermometers for the purpose were devised; but it was not till the early part of the present century that the curiosity of seamen appears to have been generally awakened to know more of the ocean than could be gleaned on its surface. John Ross, when in the Arctic seas in 1818, caught glimpses of animal life at the depth of 6000 feet; other navigators succeeded in obtaining the temperature of successive layers of water to depths exceeding 6000 feet; but, so far as I can ascertain, James Ross was, in 1840, the first to record beyond doubt that bottom had been reached, “deeper than did ever plummet sound,” at 16,060 feet, westward of the Cape of Good Hope.

The impetus to deep-sea exploration was, however, given by the demand for electrical telegraphic communication between countries severed by the ocean or by impracticable land-routes, and the past twenty years marks its steady growth. Appliances for reaching the bottom with celerity, for bringing up its formation, for registering its thermal condition *in situ*, have steadily improved, and thus the several oceans were examined both over present and prospective telegraph routes. Science, aroused by the consideration that vast fields for biological research were opening up—as proved by the returns, prolific with living and dead animal matter, rendered by the comparatively puny appliances originally used for bringing up the sea-bottom—invoked, as beyond the reach of private enterprise, the aid of Government. Wisely, earnestly and munificently, was the appeal responded to, and thus the *Challenger* Expedition has become the culminating effort of our own day.

We have now reached, in all probability, a new starting-point in reference to many of our conceptions of the physics of the globe, and our own special branch may not be the least affected. There is opened up to us, for example, as fair a general knowledge of the depression of the bed of large oceanic areas below the sea-level, as of the elevation of the lands of adjacent continents above that universal zero line. We learn for the first time by the *Challenger's* results—ably supplemented as they have recently been by the action of the U.S. Government in the Pacific, and by an admirable series of soundings made in the exploratory German ship-of-war *Gazelle*—that the unbroken range of ocean in the southern hemisphere is much shallower than the Northern seas, that it has no features approaching in character those grand abyssal depths of 27,000 and 23,500 feet found respectively in the North Pacific and North Atlantic Oceans, as the greatest reliable depths recorded do not exceed 17,000 or 17,500 feet.

The general surface of the sea-bed presents in general to the eye, when graphically rendered on charts by contour lines of equal soundings, extensive plateaux varied with the gentlest of undulations. There is diversity of feature in the western Pacific Ocean where, in the large area occupied by the many groups of coral islands, their intervening seas are cut up into deep basins or hollows some 15,000 or 20,000 feet deep. In the Northern Oceans one is struck with the fact that the profounder depths in the Pacific occupy a relative place in that ocean with those found in the Atlantic; both abyssal areas have this, too, in common,—the maximum depths are near the land, the sea-surface temperature has the maximum degree of heat in either ocean,

and two of the most remarkable ocean streams—Florida Gulf and Japan—partially encompass them.

In the Atlantic Ocean, from a high southern latitude, a broad channel, with not less than some 12,000 to 15,000 feet, can be traced, as extending nearly to the entrance of Davis Strait: a dividing undulating ridge of far less depression, on which stand the islands of Tristan d'Acunha, St. Helena, and Ascension, separates this, which may be named the western channel, from a similar one running parallel to the South African Continent, and which extends to the parallel of the British Islands. It is possible that certain tidal, and, indeed, climatic conditions peculiar to the shores of the North Atlantic may be traced to this bottom conformation, which carries its deep, canal-like character into Davis Strait, and between Greenland, Iceland, and Spitzbergen, certainly to the 80th parallel.

There is, however, one great feature common to all oceans, and which may have some significance in the consideration of ocean circulation, and as affecting the genesis and translation of the great tidal wave and other tidal phenomena, of which we know so little; namely, that the fringe of the seaboard of the great continents and islands, from the depth of a few hundred feet below the sea-level, is, as a rule, abruptly precipitous to depths of 10,000 and 12,000 feet. This grand escarpment is typically illustrated at the entrance of the British Channel, where the distance between a depth of 600 feet and 12,000 feet is in places only 10 miles. Imagination can scarcely realise the stupendous marginal features of this common surface depression.

Vast in extent as are these depressed regions—for we must recollect that they occupy an area three times greater than the dry land of the globe, and that a temperature just above the freezing-point of Fahrenheit prevails in the dense liquid layers covering them—life is sustained even in the most depressed and coldest parts; while in those areas equivalent in depression below the sea-level to that of European Alpine regions above it, animal life abundantly prevails: structural forms complicated in arrangement, elegant in appearance, and often lively in colour, clothe extensive districts; other regions apparently form the sepulchral resting-place of organisms which, when living, existed near the surface; their skeletons, as it has been graphically put, thus, “raining down in one continuous shower through the intervening miles of sea water.” Geological formations, stamped with the permanency of ages, common to us denizens of the dry land, appear, too, in these regions, to be in course of evolution; forces involving the formation of mineral concretions on a grand scale are at work; life is abundant everywhere in the surface and sub-surface waters of the oceans; in fine, life and death, reproduction and decay, are active, in whatever depths have been attained.

As a question of surpassing interest in the great scheme of nature, the economy of ocean circulation, affecting as it does the climatic conditions of countries, has of late attracted attention. The general facts of this circulation in relation to climate have been thus tersely summarised: “Cold climates follow polar waters towards the equator; warm climates follow warm equatorial streams towards the poles.” We can all appreciate the geniality of our own climate, especially on the western shores of the kingdom, as compared with the Arctic climate of the shores of Labrador, situated on the same parallels of latitude; or, indeed, with the rigorous winter climate of the adjacent North-American seaboard, even ten degrees farther to the south. These, and kindred features in other parts of the globe, have led to the summarised generalisation I have just referred to, but the *rationale* of these movements of the waters is by no means assured to us.

That ocean currents were due primarily to the trade and other prevailing winds, was the received opinion from the earliest investigation made by

navigators of the constant surface-movement of the sea. Rennell's views are thus clearly stated:—"The winds are to be regarded as the prime movers of the currents of the ocean, and of this agency the *trade-winds* and *monsoons* have by far the greatest share, not only in operating on the *larger half* of the whole extent of the circumambient ocean, but as possessing greater power, by their constancy and elevation, to generate and perpetuate currents; . . . next to these, in degrees, are the *most prevalent* winds, such as the westerly wind beyond, or to the north and south of, the region of trade winds."

Maury, as far as I am aware, was the first to record his dissent from these generally received views of surface currents being due to the impulse of the winds, and assigned to differences of specific gravity, combined with the earth's rotation on its axis, the movement of the Gulf Stream, and other well-defined ocean currents.

A writer of the present time, gifted with high inductive reasoning powers and with observed facts before him in wide extension of those investigated by Rennell, regards the various ocean currents as members of one grand system of circulation; not produced by the trade-winds alone, nor by the prevailing winds proper alone, but by the continued action of all the prevailing winds of the globe regarded as one system of circulation; and that without exception he finds the direction of the main currents of the globe to agree exactly with the direction of the prevailing winds.

Another writer of the present day, distinguished for intellectual power, and who personally has devoted much time in the acquisition of exact physical facts bearing on the question, both in the ocean near our own shores and in the Mediterranean Sea, without denying 'the agency of the winds, so far as surface-drifts are concerned, considers that general ocean circulation is dependent on thermal agency alone; resulting in the movement of a deep stratum of polar waters to the equator, and the movement of an upper stratum from the equator towards the poles; the "disturbance of hydrostatic equilibrium" being produced by the increase of density occasioned by polar cold and the reduction of density occasioned by equatorial heat; and that polar cold rather than equatorial heat is the *primum mobile* of the circulation. Analogous views had also been entertained by Continental physicists from sea-temperature results obtained in Russian and French voyages of research in the early part of this century.

We have here presented to us two distinct conceptions of ocean circulation—the one to a great extent confined to the surface, and horizontal in its movements, the other vertical, extending from the ocean surface to its bed, and involving, as a consequence, "that every drop of water will thus (except in confined seas) be brought up from its greatest depths to the surface."

With these several hypotheses before us, it may be fairly considered that the problem of "ocean circulation" is still unsolved. Possibly, too, the real solution may require the consideration of physical causes beyond those which have been hitherto accepted. In attempting the solution, it appears to me impossible to deny that the agency of the winds is most active in bringing about great movements on the surface waters: the effects of the opposite monsoons in the India and China seas furnishing corroborative proof. Again, the remarkable thermal condition of the lower stratum of the water in enclosed seas, as the Mediterranean, and in those basin-like areas of the Western Pacific cut off by encircling submarine ridges from the sources of polar supplies, combined with the equally remarkable conditions of cold water from a polar source flowing side by side or interlacing with warm water from equatorial regions—as in the action of the Labrador and Gulf Streams—points to the hypothesis of a vertical circulation as also commanding respect.

The time may be considered, however, to have now arrived for gathering



up the many threads of information at our disposal; and by fresh combinations to enlarge at least our conceptions, even if we fail in satisfying all the conditions of solution. To this task I will briefly address myself.

A grand feature in terrestrial physics, and one which, I apprehend, bears directly on the subject before us, is that producing ice movement in the Antarctic seas. We know from the experience gained in ships—which, to shorten the passages to and from this country, Australia and New Zealand, have followed the great circle route, and thus attained high southern latitudes—that vast tracts of ice from time to time become disrupted from the fringe of southern lands: reliable accounts have reached us of vessels frequently running down several degrees of longitude, sadly hampered by meeting islands of ice; and especially of one ship being constantly surrounded with icebergs in the corresponding latitudes to those of London and Liverpool, extending nearly the whole distance between the meridians of New Zealand and Cape Horn: indeed, accumulated records point to the conclusion that on the whole circumference of the globe south of the 50th parallel, icebergs, scattered more or less, may be constantly fallen in with during the southern summer.

The Antarctic voyages of D'Urville, Wilkes, and James Ross assure us of the origin and character of these ice masses which dot the Southern seas. Each of these voyagers were opposed in their progress southward—D'Urville and Wilkes on the 55th parallel, Ross on the 77th, by barrier cliffs of ice. Ross traced this barrier 250 miles in one unbroken line; he describes it as one continuous perpendicular wall of ice, 200 to 100 feet high above the sea, with an unvarying level outline, and probably more than 1000 feet thick—"a mighty and wonderful object." Ross did not consider this ice-barrier as resting on the ground, for there were soundings in 2500 feet a few miles from the cliffs; Wilkes also sounded in over 5000 feet, only a short distance from the barrier.

There is singular accord in the descriptive accounts by Wilkes and Ross of this ice region; they both dwell on the difference in character of Antarctic from Arctic ice formation, on the tabular form of the upper surface of the floating icebergs, and their striated appearance; on the extreme severity of the climate in mid-summer; of the low barometric pressure experienced—and express equal wonderment at the stupendous forces necessary to break away the face of these vast ice-barriers, and the atmospheric causes necessary for their reproduction.

From the drift of this disrupted ice we have fair evidence of a great bodily movement of the waters northward; for it must be remembered that icebergs have been fallen in with in the entire circumference of the Southern seas, and that they are pushed in the South Atlantic Ocean as far as the 40th parallel of latitude: in the South Indian to the 45th parallel; and in the South Pacific to the 50th parallel.

In the discussion of ocean circulation, it has been assumed that water flows from Equatorial into Antarctic areas; there is no evidence so far as I am aware, that warm surface water, in the sense implied, is found south of the 45th parallel. Surface stream movement northward and eastward appears to be that generally experienced in the zone between the Antarctic circle and that parallel. With, then, this great bodily movement northward of Antarctic waters included certainly between the surface and the base, or nearly so, of these tabular icebergs (and thus representing a stratum certainly some thousand feet in thickness), the question arises, How, and from whence, does the supply come to fill the created void? Sir Wyville Thomson, the leader of the *Challenger* scientific staff, in one of the later of the many able Reports he has forwarded to the Admiralty, furnishes, I think, a reasonable answer. Stating first his views as derived from study of the bottom temperature of the Pacific Ocean generally, he writes:—"We can scarcely doubt that, like

the similar mass of cold bottom-water in the Atlantic, the bottom-water of the Pacific is an extremely slow indraught from the Southern Sea." He then gives the reason:—"I am every day more fully satisfied that this influx of cold water into the Pacific and Atlantic Oceans from the southward is to be referred to the simplest and most obvious of all causes, the excess of evaporation over precipitation of the land-hemisphere; and the excess of precipitation over evaporation in the middle and southern parts of the water-hemisphere."

Before following up the great northward movement of Antarctic waters, I would draw attention to a physical feature in connection with tidal movement, which possibly may be one of the many links in the chain of causes affecting ocean circulation. The mean tide-level (or that imaginary point equi-distant from the high and low water marks as observed throughout a whole lunation) has been assumed as an invariable quantity; our Ordnance Survey adopts it as the zero from whence all elevations are given: the *Datum level* for Great Britain being the level of mean tide at Liverpool. For practical purposes, at least on our own shores, this mean sea-level may be considered invariable, although recent investigations of the tides at Liverpool and Ramsgate indicate changes in it to the extent of a few inches, and which changes are embraced in an annual period, attaining the maximum height in the later months of the year; these have been assumed as possibly due to meteorological rather than to the astronomical causes involved by tidal theory.

From an examination of some tidal observations recently made near the mouth of Swan River, in Western Australia, during the progress of the Admiralty survey of that coast, there appears to me evidence that in this locality—open, it will be remembered, to the wide Southern seas—the sea-level varies appreciably during the year; thus, the greatest daily tidal range in any month very rarely exceeds 3 feet, but the high and low water marks range, during the year, 5 feet. The higher level is attained in June, and exceeds the lower level, which is reached in November, by 1 foot or more. At Esquimalt, in Vancouver Island, fairly open to the North Pacific Ocean, there are indications of the sea-level being higher in January than it is in June; and a distinct excess of the mean level of the tide by several inches in December and January, as compared with the summer months, was traced by the late Captain Beechey, R.N., at Holyhead (see Phil. Trans. 1848). If this surface oscillation is a general oceanic feature, and some further proofs indirectly appear in the Reports of the Tidal Committee to this Association for 1868, 1870, 1872, to which I have just referred—for mention is also made of a large annual tide of over 3 inches, reaching its maximum in August, having been observed at Cat Island, in the Gulf of Mexico,—we may have to recognise this physical condition, that the waters of the southern hemisphere attain a high level at the period of the year when the sun is to the north of the equator, and that the northern waters are highest at the period when the sun is to the south of the equator. This is a question of so much interest that I propose again to revert to it.

Variations in the sea-level have been observed, notably in the central parts of the Red Sea, where the surface-water, as shown by the exposure of coral reefs, is said to be fully two feet lower in the summer months than in the opposite season; these differences of level are commonly assigned to the action of the winds. Rennell, in his 'Investigation of the Currents of the Atlantic Ocean,' states, on what would appear reliable authority, that, on the African Guinea Coast, the level of the sea is higher by at least 6 feet perpendicular in the season of the strong s.w. and southerly winds—which winds blow obliquely into the Bay of Benin between April and September, the rainy season also—than during the more serene weather of the opposite season; the proof being that the tides ebb and flow regularly in the several rivers during the period of strong s.w. winds, but that in the other season the same

rivers run ebb constantly, the level of the sea being then too low to allow the tide waters to enter the mouths of the rivers. It is possible the cause, here and elsewhere, may in part be cosmical, and neither meteorological nor astronomical in a tidal sense.

These several facts in relation to the variations in levels of the surface of the ocean are interesting, and point to new fields of observation and research.

Another physical feature connected with the ocean-level is deserving consideration: I refer to the effect of the pressure of the atmosphere. On good authority we know that the height of high water in the English Channel varies inversely as the height of the barometer. The late Sir John Lubbock laid it down as a rule that a rise of one inch in the barometer causes a depression in the height of high-water, amounting to seven inches at London and to eleven inches at Liverpool. Sir James Ross, when at Port Leopold, in the Arctic seas, found that a difference of pressure of '668 of an inch in the barometer produced a difference of 9 inches in the mean level of the sea—the greatest pressure corresponding to the lowest level. These results appeared to him to indicate “that the ocean is a water-barometer on a vast scale of magnificence, and that the level of its surface is disturbed by every variation of atmospheric pressure inversely as the mercury in the barometer, and exactly in the ratio of the relative specific gravities of the water and the mercury.” When we consider the exceptionally low barometric pressure prevailing in the Southern seas, and the comparatively low pressure of the equatorial ocean zones, as compared with the areas of high pressure in the oceans north and south of the equator—the latter features a late development by Mr. Buchan—these characteristic conditions of atmospheric pressures cannot exist without presumably affecting the surface conditions of adjacent waters.

There is yet one more point in connection with the ocean circulation which I venture to think has not received the attention it demands; this is, the economy of those currents known as “counter-equatorial.” Their limits are now fairly ascertained, and are found to be confined to a narrow zone; they run in a direction directly opposite to, and yet side by side with, the equatorial streams of both the Atlantic and Pacific Oceans. We know that they run at times with great velocity (*Challenger* experienced 50 miles in a day in the Pacific Ocean), and occasionally in the face of the trade-wind; and that they are not merely local, stretching as they do across the wide extent of the Pacific; and in the Atlantic, during the summer months of our hemisphere, extending nearly across from the Guinea Coast to the West India Islands. They have, too, this significant feature, that their narrow zone is confined to the *northern side alone* of the great west-going equatorial currents; this zone is approximately between the parallels of  $7^{\circ}$  and  $10^{\circ}$  N., and thus corresponds with the belt of greatest atmospherical heat on the earth's surface.

That the functions of the counter-currents in the physics of the ocean are important, must, I think, be conceded. They appear to act on their eastern limits as feeders to the equatorial currents, and, from the seasonal expansion, which has been well traced in the Atlantic, are probably more immediately associated with some oscillatory movement of the waters, following, though perhaps only remotely connected with, the sun's movements in declination.

A brief summary of the thermal conditions of the oceanic basins will now enable us to review the salient features of ocean circulation, and the more immediate scientific position the question has assumed.

In all seas within the torrid and temperate zones, provided any given area is not cut off by submarine barriers from a supply of polar or glacial water, the sea-bed is covered by a thick stratum of water, the temperature of which

is confined between  $32^{\circ}$  and  $35^{\circ}$  F. In the Pacific Ocean this cold stratum must be derived from Antarctic sources, for the opening of Behring Strait is too small to admit of an appreciable efflux of Arctic waters. In this ocean the cold stratum obtains generally at depths below 9000 feet from the surface, with an almost invariable isothermal line of  $40^{\circ}$  F., at from 2500 to 3000 feet from the surface. Similarly, in the Indian Ocean basin, the cold-water stratum at the bottom is derived from Antarctic sources, for the temperature of  $33.5^{\circ}$  F. underlies the hot surface waters of the Arabian Gulf.

In the South Atlantic, Antarctic waters, with a bottom-temperature of  $31^{\circ}$  to  $33.5^{\circ}$  F., certainly cross the equator; the bed of the North Atlantic basin then warms up to  $35^{\circ}$ —marked diversities in both the temperatures and thickness of the successive layers of water from the surface downwards are found; and in the central parts of the basin it is not until the vicinity of the Farøe Islands is reached that Arctic waters of an equivalent temperature to those from Antarctic sources are experienced.

Turning now to the scientific aspect of the question:—The doctrine of a general oceanic thermal circulation assumes two general propositions: 1, the existence of a deep under-flow of glacial water from each pole to the equator; and 2, The movement of the upper stratum of oceanic water from the equatorial region towards each pole, as the necessary complement of the deep polar underflow—this double movement being dependent “upon the disturbance of hydrostatic equilibrium, constantly maintained by polar and equatorial heat.” Proposition 2, in its general application as to the movement of surface-waters, is unquestionable; but that of a deep underflow from the poles, as a necessary complement, remains open to doubt. Proposition 1, in its wide generality, must, from what we know of the Pacific, be confined to the Atlantic Ocean; and it appears to me that it is on the interpretation of the movement of the waters in its northern basin that the hypothesis of a vertical circulation, and the potency of thermal agency in bringing it about, must be judged.

We have followed the movements of Antarctic waters in the Atlantic to the 40th parallel, as illustrated by the progress of icebergs; we know that the movement deflects the strong Agulhas current, and that the cold waters well up on the western shore of the South African continent, cooling the equatorial current near its presumed source; the thrusting power of this body of water is therefore great. About the equator it rises comparatively near to the surface. But we now come to another and distinct movement—the equatorial current; and on this, I apprehend, the material agency of the winds cannot be denied, in forcing an enormous mass of surface-water from east to west across the ocean. The Gulf Stream results, and the comparative powers of this stream, as especially influencing the climate of our own and neighbouring countries, together with the forces at work to propel its warm waters across the Atlantic, have become the controversial field for the upholders of horizontal and vertical circulation. The one hypothesis assigns to the Gulf Stream all the beneficent powers of its genial warmth—extending even beyond the North Cape of Europe—which have been conceded to it from the time of Franklin. The other hypothesis reduces its capacity and power, considers that it is disintegrated in mid-Atlantic, and that the modified climate we enjoy is brought by prevailing winds from the warm area surrounding the stream; and to this has been more recently added, “by the heating power of a warm sub-surface stratum, whose slow northward movement arises from a constantly renewed disturbance of thermal equilibrium between the polar and equatorial portions of the oceanic area.”

Without denying the active powers of this disturbed thermal equilibrium—although in this special case it is an abstraction difficult to follow—and giving due weight to the many cogent facts which have been brought forward in support of both views, there appears to be still a connecting link or links

wanting to account for the southern movements of Arctic waters, which movements, to me, are even more remarkable as a physical phenomenon than the translation of the warm waters from the Gulf Stream area to a high northern latitude.

This movement of Arctic waters is forcibly illustrated by the winter drifts down Davis Strait of the ships *Resolute*, *Fox*, *Advance*, and of part of the crew of the *Polaris*, when enclosed in pack-ice, exceeding, in some cases, 1000 miles; similarly, of the winter drift of a part of the German expedition of 1870, down the east side of Greenland, from the latitude of  $72^{\circ}$ , to Cape Farewell. If to these examples we add the experience of Parry in his memorable attempt to reach the North Pole from Spitzbergen in the summer of 1827, it must be inferred that a perennial flow of surface-water from the polar area into the Atlantic obtains, and, judging from the strength of the winter northerly winds, that the outflow is probably at its maximum strength in the early months of the year.

When we further know that the northern movement of warm waters gives, in winter, a large accession of temperature to the west coast of Scotland, to the Farøe Islands, and extending to the coasts of Norway as far as the North Cape; the consideration arises whether this onward movement of waters from southern sources is not the immediate cause of displacement of the water in the Polar area, and its forced return along the channels indicated by those winter drifts to which I have referred.

That some hitherto unlooked-for and unsuspected cause is the great agent in forcing southern waters into the Atlantic polar basin has long forced itself on my conviction, and I now suspect it is to the cause producing the annual variations in the sea-level,—for, as I have mentioned, indications exist of the seas of the northern hemisphere having a higher level in winter than in summer,—that we must direct our attention before the full solution of ocean circulation is accepted.

The facts of the annual changes of sea-level, whatever they may ultimately prove, have hitherto ranged themselves as part of tidal action, and so escaped general attention. Physicists well know the complication of tidal phenomena, and, if one may be permitted to say, the imperfection of our tidal theory; certain it is that the tides on the European coasts of the Atlantic are so far abnormal that one of our best authorities on the subject (Sir W. Thomson) describes them, in relation, I assume, to tidal theory, as “irregularly simple,” while the tides in all other seas “are comparatively complicated, but regular and explicable.” However this may be, specialists should direct their attention to the disentanglement of the variations in the sea-level from tidal action simple; and our colonies, especially those in the southern hemisphere, would be excellent fields for the gathering in of reliable observations.

I am unwilling to leave the subject without tracing some of the consequences that might be fairly considered to follow this assumed change of level in the North Atlantic basin. We can by it conceive the gradual working up of the warmed water from southern sources as the winter season approaches, including the expansion of the Gulf Stream in the autumn months; the consequent welling-up of a head of water in the enclosed and comparatively limited area northward of Spitzbergen, Greenland, and the broken land westward of Smith Sound; the forced return of these glacial waters, their greatest volume seeking the most direct course, and thus working down the Labrador coast charged with ice, and passing the American coast inside the Gulf Stream; while the smaller volume, reaching the higher latitudes in mid-Atlantic, interlaces with the warm barrier waters, causing those alternating bands of cold and warm areas familiar to us from the *Lightning* and *Porcupine* observations, and which

are now being worked out by the Norwegian exploring expedition in the Government ship *Vöringen*.

We can further conceive that the larger function of the "counter-currents" on the north margin of the great equatorial streams is to act as conduits for the surcharged waters of the northern oceans consequent on the gradual changes of level. The Atlantic counter-current, we know, expands markedly in the autumnal season, and there may be some connection between this expansion and the high level of the waters said to exist in the Gold Coast and Guinea bights at the same season.

We are thus, as it appears to me, now only on the threshold of a large field of inquiry bearing on the Physical Geography of the sea; but we have this advantage,—the admirable discussions which have taken place in the past few years, productive as they have been of the marshalling hosts of valuable facts, will lighten the labours of those who engage in its prosecution. Science is deeply indebted to, and, I am sure, honours those who have so earnestly worked on the opening pages of the coming chapter on ocean circulation.

## 2. *The Ascent of Mount Ararat in 1856.* By MAJOR ROBERT STUART.\*

THE sun rose in all his glory at Bayazid on the 11th July, 1856. There was not a cloud in the sky to intercept his rays, and, with the exception of an occasional breeze that swept lightly down from the mountains, the atmosphere was calm and still. So far as could be prognosticated in these regions of fierce and sudden changes, the weather was set in fair.

As the Expedition of which we are about to write was novel in its object, and not without importance in its results, it is but fair towards the gentlemen who were engaged in it to give to their names an early and prominent place in the narrative. These gentlemen were as follows:—The Rev. Walter Thursby, Major Fraser, Mr. James Theobald, Mr. Evans, 9th Lancers, and the writer, Major Robert Stuart. Majors Fraser and Stuart and Mr. Evans formed part of a British Staff that, during the war, had been attached to the army of Anatolia. Messrs. Thursby and Theobald were travelling in those parts for their own amusement. It would be too much to aver that the above names will live in the future traditions of the country round Ararat, for English names are distorted into curious shapes by Oriental lips; but in some form or other they will long be remembered with pious respect in the plains and villages of those parts, from their associations with the sacred heights of Aghri-dagh.

Our cortege consisted of Iss-hak Bey, Chief of the Ararat Kurds, to whose special care we had been committed by the Kaimakam of Bayazid, Hadgi Mustafa Effendi, a zaptieh, or native policeman, who, in addition to other functions, acted as interpreter between our party and the Kurds. Our dragoon, a Smyrniote, who figured in the remains of an expensive British Staff uniform and a suridji to take charge of the horses. Punctual to the minute all these functionaries were ready at their posts at the appointed time. Iss-hak Bey presented himself in full costume, armed and accoutred as if for a foray. He was mounted on his favourite mare, a beautiful specimen of the pure Kurdish breed. Undersized to English eyes, she was perfect in the symmetry of her proportions, which exhibited all the indications of speed, strength, and power of endurance; there was a subdued fire in her large gazelle eyes, and her satin skin of bright chestnut was without a flaw, except

\* Being the hitherto unpublished private journal of the event, by Major Stuart; communicated to the Society by his sister-in-law, Miss Charlotte Cutheart.

the brand marks on her head and neck, by which were distinguished her pedigree and the tribe to which she belonged. There was an English Bey whose eyes were long riveted in deep admiration on the Kurdish mare, to the evident gratification of her owner. Covetous thoughts arose; but it was of no use, money could not have bought her. We verily believe that Iss-hak Bey would sooner have parted with his favourite wife than with that mare.

Everything being ready, we started soon after the sun had well cleared the horizon. Early as it was the housetops were crowded with spectators as our cavalcade defiled through the narrow streets. Iss-hak Bey took the lead, evidently elated with the honour and responsibility of his charge. He rode on in dignified silence, gracefully waving at times his long tufted lance, the shaft of which was of best Persian bamboo, as springy as whalebone, and as tough as an oak. The *zaptieh* also was brimful of importance, but he showed it in a different manner; silence formed no part of his character, and in the choice phraseology of the bazaars it would perhaps have been difficult to find his rival. Moreover the nature of his calling had invested everything vagabond with an attraction for him; and woe betide the ragged urchin or poverty-stricken wretch that came within reach of his kurbash. But after clearing the town, all this ceased; pipes were lit, pleasant chat sprang up, and by degrees everything settled into the order of the day's march. Arrived on the plain, we bore off in a direction north-east, passing on the left some fields which had formerly been enclosed and cultivated as vineyards. In 1829 they were laid waste and utterly destroyed by the Russians, and to this day they remain in the condition in which they were left by these remorseless enemies. An elevated rocky ridge, forming a natural escarpment and extending from the summit of the mountain, on which Bayazid is built, to the plain, shelters the town to the east. On doubling the lower extremity of this ridge, we obtained for the first time a full view of the stately Ararat from the base to the summit.

The snow-clad cone stood out in distinct relief against the morning-sky, cold, grand, and forbidding. By some perspective illusion, the lesser peak, though 4000 feet lower, and some miles more distant, seemed the higher of the two. This can be explained by the principles of optics; but we fear in a manner that would not interest many of our readers. One useful lesson, however, may be learned from this fact: namely, that travellers should be careful in trusting to first impressions, seeing that the senses are apt to be misled when first brought into contact with unaccustomed objects. We now struck off in a north-easterly direction across the plain. One hour from Bayazid we came to the Shekheli, a deep narrow stream as clear as crystal, that, collecting the watershed of the adjacent mountains, winds round the base of Ararat and unites with the Arras. We traversed this stream by means of a handsome one-arched bridge of Genoese construction, much impaired, like all its kindred works in this country, by the hand of time and the roughness of the elements. The parapets have been swept away, the foundations show signs of weakness, and the traveller of next year will perhaps find it gone.

The plain of Bayazid, unlike those of Alishkurd, Passine, and Erzeroum is, for the most part, barren and repulsive, yielding nothing but a sparse, lank grass, insufficient for pasture. The soil is everywhere stony and the stone volcanic. After crossing the Shekheli we observed much that would interest the naturalist: small lizards of a brown colour were in some places so numerous that they started aside in scores from every footfall of our horses, while at the same time swarms of large red-winged beetles buzzed pertinaciously around us, and every now and then we crossed the shiny trail of snakes; gray partridges abound on the stony ground at the foot of the mountains, crows and swifts are seen in scanty numbers, and further on some indications of man appear in the few wretched villages which, without inhabitants in summer,

form the retreat of the Ararat Kurds when the approach of winter drives them from the heights. Here the plain assumes a more genial aspect, extensive meadows and cornfields meet the view, and beyond these was a forest of tall reeds where, according to our zaptieh, wild swine make their lairs, while bears and wolves are to be found in the neighbouring heights. Thus far we kept to the plain, skirting the base of the mountain and following the salient and re-entering angles of its shoots. But at length, after doubling a surging projection composed of broken masses of basalt, we struck to the left and commenced the ascent through a broad opening enclosed between vast ridges of volcanic formation. For the first hour after quitting the plain, the ascent was, with a few rough exceptions, easy and gradual. Our path followed the windings of a noisy stream which irrigates at intervals in its course patches of fertile land, yielding at this season wheat, or barley, or hay. On one of these plateaus, which spread out to some acres, a halt was unanimously agreed upon. Off-saddling and knee-haltering our horses, we gave them the range of the pasture, where they enjoyed their brief respite from toil, rolling, grazing, and fighting by turns.

We were soon reseated in our saddles, and now our way constantly increased in difficulty, becoming at every step more rocky and acclivitous. Our trusty little horses were, however, perfectly at home at this work; with the agility and circumspection of a cat, they carried us safely and jauntily over ground that would try the nerves of any one not accustomed to the horsemanship of Armenia.

After an hour or so of this tedious work we reached what might be designated the shoulder of the mountain. Here the ground became easier, the plateaus more frequent and extensive, and sheltered spots presented themselves suitable to the abode of man. The climate too was gradually changing for the better: instead of the hot air of the plain we were now inhaling a light breezy atmosphere, tempered with an occasional dash of cold, as every now and then a gust of wind fresh from the upper snows swept down upon us. With the advance of day a mantle of rolling clouds had gathered round the cone; near at hand, however, there was enough for present interest. We were now about 5000 feet above the plain, and as we were slowly working our upward way we came upon the first encampment of the Ararat Kurds. It was situated in a sheltered hollow where there was good water and green pasture in abundance; the black tents of Kedar harmonised well with the character of the surrounding scenery, while the dwellers therein, with their swart faces, piercing eyes and outlandish dresses, gave the finish of life to the whole. Our unexpected arrival and strange appearance created an immense sensation amongst these wild people. They turned out in crowds to see us, but hospitality was their first thought; wooden bowls of "Iran," or sour milk diluted with water, were brought forward in quick succession, and not until we were sufficiently regaled did they give way to their curiosity: then old men and maidens, haggard gypsy-like women and young children, all gathered round to survey the strangers from Frankestan; even their dogs, which, by the way, are famed for strength and ferocity, manifested their excitement by a sustained chorus of angry barking.

Pushing on thence, we passed these detached encampments at frequent intervals; and at 3 P.M. we reached the quarters of the chief himself, at an elevation of about 6000 feet above the plain. It appeared that on the preceding day he had sent off an express to give notice of our intended visit, and everything was accordingly in readiness on our arrival.

A large portion of the chief's tent had been walled off for our use, the floor was covered with their best Persian carpets, and Kurdish taste and appliances were taxed to the utmost in order to produce an imposing effect. We were not long in making ourselves at home. Our horse gear and baggage were brought



into the tent and conveniently stowed away; the horses, picketed in front of the huts, were consigned to the care of the women, pipes and coffee were served, and Iss-hak Bey, in the character of host, waited on us with due ceremony and bade us welcome to his tent. While the chief was sitting with us, his people began to collect in numbers at the tent door, watching our every movement with those keen black eyes of theirs, which, glancing with incessant motion from beneath thick shaggy eyebrows, seemed to possess superhuman quickness and power. By a benevolent appointment of nature those faculties upon which we are most dependent are mostly invested with additional efficiency in proportion to the services required of them. The Kurd may be said to live by his eyes, whether it be in spying out his quarry afar, or in detecting the stealthy movements of his enemy, or in reconnoitring the intended scene of his forays. His vision, thus constantly exercised from childhood, acquires an almost telescopic power; and on many occasions during our sojourn amongst them we were amazed at the quickness and range of their sight. The Kurdish women are free from the affected coyness of their Turkish and Armenian sisters. In the crowd assembled, as we have said, at the door of the tent were several women, and even the Bey's wives did not stand aloof. He had two of them: one an elderly dame, whose province it was to superintend rather than to perform the domestic duties; she was a hard-worked shrivelled creature, with nothing to distinguish her from the humblest of her sex in the encampment. It was far different with the other, who, it will at once be perceived, was the favourite wife. She was still young, perhaps not more than twenty-five, although in appearance more aged than an English woman of forty. And yet she was exempt from the drudgery which so soon breaks down her less favoured countrywomen. Good-looking for a Kurdess, and rather tall, she had evidently taken much pains to improve her natural advantages by dress. A minute description of her would not be interesting; but we may observe that her ornaments consisted of a profusion of gold coins which were strung thickly together to form her forehead band, necklace, and bracelets. Several times during our stay she came into our portion of the tent under the pretence of looking for some mislaid article, and was evidently much pleased with the respectful manner in which she was received.

Our conversation with the Bey, as he sat among us, naturally turned on our projected expedition. Many were the arguments and earnest entreaties he used to dissuade us from it. The latest attempt, he told us, had been made by a Russian Bey some twelve years ago, who came with a large party and great preparations. According to custom, sheep were sacrificed at the base of the cone to propitiate Kissmet (fate), and a portion of the flesh was taken up by each man; but all to no purpose: they could not get to the top, and it was with difficulty they all got back alive, for some were snow blind, some were frost-bitten, and one had his leg broken (this was Professor Abich and his party, of whom more hereafter). "Kissmet," added the Bey, "forbade the attempt, and who can prevail against Kissmet?" "But," observed an English Bey, "our Kissmet is different from yours, and what is forbidden to you may be allowed to us." "True," replied the Kurd, "God is great, and you English are wise; it is not for us to say what you can do." "Inshallah!" exclaimed the listeners at the door. After this no question on the subject was again started.

The tribe of which Iss-hak Bey is chief, numbers about five hundred men. During the summer months they are distributed in detached encampments over the southern shoulder of the mountain, where, in the sheltered dells, and on the green slopes, they find crystal rills and sweet pasture in abundance; while farther down, towards the plain, every patch of available soil is appropriated to hay or cereal crops. Each encampment numbers some six

or eight tents, all of black goat's hair, the spinning and weaving of which forms, as has been before observed, an important part of female employment. Here a primitive and apparently happy state of society exists, under a government strictly patriarchal. Each encampment has its own little chief, who again is subordinate to the Bey. Mixing little with other tribes, or with any beyond their own sphere, they are almost unacquainted with barter; their wants are consequently few and simple, and such as each family can make provision for. With good tents, warm clothing, and wholesome food in abundance, their condition may well be envied by many whose lot is cast amid the boasted advantages of civilization. With them there is no poverty; their disquietudes are few and transient, their bodily ailments light and easily healed. The women labour cheerfully in the tent and in the field, while the men saunter about in idleness, never going without arms, so as to be prepared for any danger or temptation that might unexpectedly arise. Amongst themselves there is a bond of mutual honesty and fair play; but in his dealings with all others, the Kurd is an unblushing avowed rogue and cheat. Every tent is guarded by its own special dogs—large, strong, savage animals; and so faithful to their charge, that they will not allow dog or man of another tent to invade their beat. They made a terrible row when we came first amongst them, but they were not long in recognising in what position we stood. The Bey's dogs at once fraternised with us; but the others, though consenting to our presence in the camp, would warn us off whenever we approached their tents, until they saw how it was between us and their masters.

These Kurds, as has been already stated, change their place of abode with the seasons. In the month of May, when the winter is well past, and spring vegetation has made some progress, they move with their penates, families, and all they possess, to the heights, returning to the plain towards the end of September, when frequent atmospheric commotions announce the dangers of a prolonged stay at such an elevation.

Their villages in the plain, which are thus deserted for several months in the year, are of the most primitive description, being nothing more than mud contrivances; in which the inmates, sheltered from cold, pass a long hybernation, in company with their horses, sheep, and cattle, besides vermin of different sorts in visible swarms.

While we were thus engaged in pleasant converse with our host, active preparations were going on elsewhere for our evening meal. A goodly odour of stews and kibauts arose from the neighbouring tent; and the Kurdish *chef-de-cuisine*, aided by our own servants, exercised his utmost skill in producing a repast worthy of English Beys. Before it was served, the younger son of Iss-hak Bey, a handsome lad about ten years old, came into the tent, and, with becoming grace, presented us each with a bouquet of wild flowers. The elder brother was a couple of years older. He was weakly, and of tender eyes. The father brought him to us in hope that we might be able to prescribe for him. Alas! we could do nothing. The father then, after tenderly caressing him for awhile, shot into each eye a plentiful discharge of spittle, upon which the grateful youth bowed reverently and retired. Our evening wore away agreeably enough. By degrees all noises ceased throughout the camp, until perfect silence prevailed at an early hour, for this primitive people lie down and rise with the sun.

Rising with the first streak of dawn, the "sigan" of hot coffee was soon got ready and circled round. Every man charged himself with a small supply of provisions and a coil of strong jack-line in addition to his trusty pole with an iron spike at one end and a hook at the other. We had also among us a race-glass, a small hatchet, and a leather bottle of rum. Thus equipped we started off in full confidence of success, being accompanied by

Iss-hak Bey and the zaptieh on horseback, and two or three men on foot. There was, however, one drawback to the anticipated pleasure of the day, namely the illness of the Rev. Mr. Thursby, by which we were deprived of his company. This illness, which happily was not of a serious nature, had come on during the night, and, as he required nothing but repose, we thought we might safely entrust him to the care of our Kurdish friends.

For the first hour or so our progress was comparatively easy, the ground differing but little from that which we had traversed on the preceding day—the same green plateaus, well watered and in some places sheltered by huge ramparts of volcanic rock. At an hour's distance from the Bey's quarters, we came upon the most elevated of the detached encampments. It numbered seven tents, and was situated upon an extensive well-watered plateau, about 6000 feet above the level of the plain. Beyond this the aspect of nature became at every step more sterile, wild, and forbidding. The radiating ridges of basalt increased in height, became more rugged and impracticable. A track, known only to the mountaineers, enabled us, however, to make tolerable progress. After two hours we were obliged to relinquish our horses; for it was now a scramble up and down precipices, and over masses of broken rock, where only men or mountain-goats could find footing. It was pleasant to see every now and then, amid all this desolation, a patch of green peep out from beneath some sheltered nook, on which was to be found in abundance forget-me-nots, double daisies, gentianella, and primulas, all growing in unromantic fraternity with wild shalots. After three hours of stiff work, we arrived at the foot of the cone, which, owing to the continued fineness of the weather, we were enabled to see to the very summit; and it was no ordinary sight. We stood in the immediate presence of the vast cone-shaped mountain, 6000 feet high, covered with eternal snow to the very base!

Arrived at the foot of the cone, our Kurdish friends declined proceeding any further, and we held a consultation as to the best mode of ascending. Independence of thought and action is the well-known characteristic of Englishmen. This spirit, we need scarcely say, manifested itself in our council. The end of it was that three decided upon trying the ascent on that part of the mountain that lay just in front of us, keeping as much as possible to the snow, while the fourth, Major Fraser, chose a line for himself, bearing away to the right, in the intention of availing himself as much as possible of those parts from which the snow had disappeared. His reasons were good. He had had much experience in rough mountain work in South Africa, where snow is unknown, and he did not deem it prudent on the present occasion to essay an element that he had not proved; whereas of the others, two were experienced Alpine travellers, accustomed to glaciers and eternal snows.

For the present, leaving Major Fraser to himself, let us follow the movements of the others. The line of ascent being determined on, the grand work of the day began in real earnest. It was now six o'clock, and we had already been three hours on foot, working upwards against difficulties of no ordinary character; but as yet no one dreamt of fatigue; on the contrary, it appeared as if these three hours had been but a preparative for the day's work. A bit of unleavened bread, and an occasional mouthful of snow, served to sustain the strength and to ward off hunger, without loading the stomach or touching the wind—the two great evils to be avoided on occasions of great bodily exertion. For some time we held pretty well together, making on the whole satisfactory progress. But, after the first 1000 feet put differences in our climbing powers, the snow, with which previous experience had familiarised Theobald and Evans, sorely taxed the unaccustomed limbs of Major Stuart, who accordingly turned aside to a projecting ridge of broken basalt, which extended far up towards the summit. To one standing at the

foot of the cone this ridge would present the appearance of a paved road, but it consisted in reality of huge masses of basalt, thrown together by volcanic force in making way over which the utmost agility and circumspection were required to guard against the chances of broken limbs.

At this time Theobald was some hundred yards in advance. Evans and Stuart had so far held pretty well together, but the latter now giving in, the former followed, with gradually increasing interval, on the traces of Theobald. On, on they went, higher and higher; now lost to sight in a fleecy cloud, now re-appearing, but diminished to little moving specks on the upper snows. The higher they ascended the greater the difficulties they had to contend with. As the air became more rarefied the action of the lungs was quickened, and every effort told more sensibly upon the strength. At the same time the angle of the slope continued to increase, while the footing became more difficult, because the upper part of the mountain is perpetually coated with an encrustation of ice, lightly sprinkled over with snow. For, during the summer months, the heat of the sun is sufficiently powerful to melt the snow in those elevated regions whenever the absence of clouds and mists permits his rays to have their full force; but let them be intercepted but for a moment, and their effects are counteracted by the normal temperature of the atmosphere, which at all seasons is below freezing point; over the icy crust thus formed the snow, swept from the neighbouring drifts by the never-ceasing wind, collects in a thin layer as fine and as dry as powder, deep enough in some places to conceal what is beneath, but not to afford a firm foothold.

The utmost circumspection is consequently required at each step in climbing this part of the mountain; and the spiked staff will be found of invaluable service, as well in sounding the surface as in aiding the precarious efforts of the feet. Theobald and Evans, as has been already noticed, were experienced Alpine climbers, and, being strong of limb and sound of wind, they held successfully on their upward course, without check, slip, or drawback, until at 2 o'clock P.M. the former crowned the final difficulty, and found himself on the summit of Mount Ararat. He was followed at an interval of about an hour by Evans, who, though less active, had equal perseverance.

Leaving them for a while to their own musings on this solemn height, let us now return to Major Stuart, whom we left, some three or four hours back, in an exhausted state 4000 feet lower down. A feverish cold, from which he had been suffering for some days previously, had much impaired his strength, and thrown him out of that condition necessary to the performance of a severe or protracted physical effort. He did not feel this at starting; the excitement of the occasion, the first flush of returning health, and the bracing effects of mountain air, had inspired him with a premature confidence in his own strength. As we have seen, he got on very fairly for a time, holding his own with the others; but the undertaking was beyond his force, and he was obliged to give in after ascending about 2000 feet of the cone. Sitting down under the shelter of one of those masses of basalt over which he had been climbing, a drowsy feeling came over him, and he was soon fast asleep. In about an hour he awoke somewhat refreshed, and, on looking around, he found himself the object of attentive consideration to a number of ibises grouped on a rock close by, from whence they could carry on their survey in safety. Curiosity and astonishment had imparted increased lustre to their beautiful eyes as they examined with earnest gaze this strange intruder on their domains. On perceiving him move they bounded away, springing with light unerring foot from point to point over the rocks, and soon were lost to view. What had led them up so far it would be hard to say, for at the level of 13,000 feet above the sea there is no vegetation except some scanty lichen, which could not serve for food to these animals. Some small birds were also seen on the wing at this height, but of what species there was not sufficient opportunity of judging. Above this all was solitude, silence, and snow.

Major Stuart, finding himself unable to proceed higher, now addressed himself to the task of descending. To accomplish this step by step would have been too laborious; he therefore resolved to try what could be done by a glissade. The angle of the mountain-slope with the horizon was in this place about  $35^{\circ}$ . Taking his seat then on the snow, he looked well to his balance, steadied himself with his staff, and, giving way, off he went like an arrow shot from a bow, and in the course of a few minutes he found himself once more safe and sound at the foot of the cone. Iss-hak Bey, who, from a convenient position, was keeping close watch on every movement of our party, sent forward one of his men to meet the unsuccessful climber, received him with every demonstration of respect when he joined him, gave him his pipe and bade him welcome. "The English Bey is, no doubt, very brave and very enterprising," said he, "but he has attempted what is beyond the strength of man, and what, according to the traditions of my race, is contrary to the will of Allah. You were wise not to ascend any higher, and my heart is throbbing for the two other noble Beys who are at this moment hidden from view far up among the driving mists, Allah Rerem (God is good)." "Fear not, great chief," replied the Major, "they are younger and more active men than I am, and, Inshallah, they will succeed." "Bakalum" (we'll see), was the only rejoinder; and the Major, returning to the chief his pipe, lay down on a green spot, sheltered from the sun's rays by an overhanging rock, and fell into a profound sleep, more grateful than Sybrite ever knew on bed of roses. From this almost comatose state he was suddenly recalled to waking existence by the exclamations of Iss-hak Bey and his attendants. Theobald had just gained the summit of the mountain; at that moment there was not a cloud to intercept the view, and, notwithstanding the great height and distance, the Kurds were able with the naked eye to follow all his movements. "Mashallah!" cried the chief, "God is great, and you English are wonderful people! We have always thought, and our fathers before us thought, that God had made that holy mountain inaccessible to man; many have tried to ascend it, but no one has ever succeeded until you come, and without any preparation walk straight up from the base to the top. Allah be praised! we have heard strange things of you, but now we see them with our own eyes." All this time the Kurds were straining their keen, dark eyes towards the mountain-top, and exclamations of surprise, uttered in their native tongue, followed in quick succession as they watched the movements of the two climbers. The power of vision possessed by this people is truly astonishing; almost equalling that which Europeans attain by the means of telescopes. It can only be accounted for by the constant activity imposed upon the organ by their social habits, to which perhaps may be added their simple diet and the purity of the atmosphere in which they live.

As has been already mentioned, Mr. Theobald was the first to reach the summit; it was about two o'clock when he gained the highest point, where, after somewhat less than an hour, he was joined by Mr. Evans. After making a few observations as to the shape and extent of the top, they commenced together the work of descending, and, keeping closely to their tracks of the morning, they got back in safety to the tents at 6.30 p.m.

We must now follow the movements of Major Fraser, who, it will be remembered, chose a line of his own. Diverging from the point where the others commenced the ascent, he skirted the base of the cone until he found what appeared a more practicable slope on the south-eastern side.

The plane from this point to the summit was apparently even and unbroken, and presenting an uninterrupted surface of snow, it seemed to promise easier work for the feet and in general greater facilities of ascent: therefore, notwithstanding the want of previous experience in snow-climbing, he determined on this line. As long as the snow was soft he found the work easy

enough; step by step for hours he industriously kept a direct course, and had got within 1000 feet or so of the summit when he began to experience the difficulty of footing arising from the icy incrustation already described. In attempting to strike across to what appeared an easier line, he slipped in stepping on a sheet of ice lightly covered with snow, and, losing all control over himself, downwards he went with a rapidity which promised to bring him quickly to the point from which he started in the morning. Utterly unable to arrest his downward course, all he could do was to keep himself well on his back, body rigid, and legs stuck out. Natural instinct suggested these precautions; without which he might have spun round like a trencher, been deprived of consciousness and lost. As it was he came off unhurt. After a glissade of 1000 or 1200 feet, the snow, becoming deeper and softer, collected in such quantities between his legs as gradually to retard his speed, and at length it brought him to a stop. But now what was to be done? the loss of so much time, distance, and labour in an undertaking of this kind was certainly most serious, but failure from a cause of such trifling sound as a mere slip of the foot would have been worse than mortifying, it would have been ridiculous by his easy ride over the snow; so readjusting his nerves, and bracing up his energies for a renewed effort, he made his way with some difficulty across the snow to a ridge of basalt that, commencing near the summit, extended downwards about 2000 feet. This ridge consisted of masses of basalt, and over its crest Major Fraser now sought to make his upward way. Such resolution deserved its reward; by dint of great labour and perseverance he succeeded in gaining the summit at about 3.30, having exchanged signals with Theobald and Evans, who had by this time accomplished some hundred feet of the descent. After reaching the highest point, he kept to their tracks in descending, and got back to the tents at midnight. His return was hailed with great satisfaction by the rest of the party, who, as night wore on, had become more and more anxious for his safety; for it is easy to conceive how great are the dangers to which one would be exposed at night on those rugged heights with no light but the delusive glare of the snow and no shelter in the event of one of those sudden storms which often burst with terrific violence in elevated mountain regions. Our apprehensions had, nevertheless, yielded to the presence of fatigue, and we were all sunk in sleep and forgetfulness, when the fierce barking of the watch-dogs recalled us to consciousness, and before we could well collect our scattered thoughts, the Major entered the tent accompanied by a guide, whom he had procured at the upper encampment. A light was instantly struck, refreshment ordered, and while these were forthcoming we listened with breathless interest to the narrative of his day's adventures.

The Bey and some of his chief men were not long in making their appearance. They had altogether relinquished the hope of seeing the Major again, looking upon him as the victim which must needs have been sacrificed for what they considered an enterprise of temerity and folly; but when they saw him back amongst them, unscathed in life or limb, then indeed they began to feel the force of what we asserted, viz., that many things forbidden to the Kurds are allowed to the English.

When the Major had finished his repast, the chief retired, and sleep and silence again reigned in the camp until dawn. For these simple children of the mountain imagine in their innocence that the hours of darkness were designed for repose, of daylight for activity; they retire, therefore, with the sun, and wake up ere his earliest beams gild the eastern hills. There certainly is a charm in this mode of life, to be appreciated by those only who have tried it; and never is the sense of life more bounding and joyous than in the morning, when, rising with the sun, we sally forth into the fields and inhale the breeze still fresh with dew. It must be confessed

that none of our party was disposed for this sort of enjoyment on the morning succeeding the events we have just related; for in addition to the fatigue resulting from a day of such unusual toil, two of them were suffering from severe inflammation of the eyelids, brought on by the glare of the snow. As they were unable to bear the light, they remained in the tent for the greater part of the day, their eyes bandaged with a wet towel. By this means the inflammation was soon reduced, and in the afternoon they were sufficiently recovered to go about as usual. We have now done with the ascent as performed by Major Fraser and Messrs. Theobald and Evans. If the subject is not worn threadbare, we would ask the reader to accompany us while we briefly relate how the same feat was accomplished by the Rev. W. Thursby and Major Stuart. It may be said that we are going a second time over the same ground. This is substantially true; but still there will be found some features of separate interest not altogether unworthy of attention.

They set out early in the afternoon of the 13th July, having decided upon devoting two days to the work. On the first, to ascend as far as might be deemed safe before sunset; then sheltering themselves as well as they could for the night, to finish the task on the following morning. Two young Kurds accompanied them from the tents, carrying their rugs and sheepskin cloaks, together with a small supply of provisions, consisting of unleavened bread, cold mutton, a small flask of brandy, and another of tea. Very little experience suffices to show that in threading difficult passes or breasting steep ascents, nothing is more injudicious than haste, or more fatiguing than a false step. The muscular effort necessary to retrieve the latter takes more out of a man than a hundred paces surely and effectively made. Aware of this fact, Major Stuart and his friend proceeded slowly and cautiously, husbanding their force with the utmost care, and looking well to their footing at every step. By this means they reached the foot of the cone with strength still unimpaired. They then turned off towards the south and began the ascent on a part of the south-eastern flank, which the combined action of sun and wind denuded in summer time of snow. By 6 o'clock P.M. they had gained an elevation of about 2000 feet above the base of the cone, and here their Kurdish attendants came to a stop and refused to proceed any further, alleging in justification ancestral traditions and the fear of treading on hallowed ground. The attempt to combat such arguments would have been a simple waste of time and words. In point of fact, the young Kurds had ascended higher than had been expected of them. They were accordingly dismissed in the most gracious manner possible; but to ensure their return in the morning for the rugs and coats, it was deemed advisable to detain their guns and swords, assigning as a reason the danger of wild beasts or robbers. There was some difficulty about this, for the Kurd does not feel to be himself without his beloved weapons; but every objection was overcome by the promise of *bakshish* (reward), a mode of persuasion by which we verily believe the Kurd could be induced to lay down his life, much more his arms. Major Stuart and Mr. Thursby, now left to themselves, set diligently to work to prepare shelter for the night. The wind was from the west, and blew sharp and strong. About 700 yards to their left, and nearly on the same level with them, lay a field of glaciers, the only ones to be seen on the southern slopes of the mountain. Their halting-place was on a mass of limestone-boulders that varied in size from one to five feet in diameter. To their right was a bed of snow, along the inner edge of which trickled a little thread of water, which no doubt was produced by the heat of the limestone acting on the snow. Here, on the lee side of the stony bank, they scooped out a hollow by removing the boulders, and piling them up to windward, they secured to themselves complete shelter from the wind. By a handy adjustment of the boulders, a tolerably level surface was obtained,

six feet long by four in width, on which they could both lie down ; they chose out a couple of smooth stones for pillows, and thus, with the addition of rugs and cloaks, no bad resting-place was prepared for the night.

Sunset was at hand by the time these operations were completed, and our adventurers now sat down to contemplate without distraction this glorious spectacle. The day had been fine throughout, and at the time we speak of there was not a cloud in the sky, nor a particle of mist to be seen in the vast horizon around. The sight, travelling far over the mountains and plains of Georgia, Azerbaijan and Kurdistan, was fairly lost in space and found its limit only in the dim amalgamation of earth and sky. The Araxes flowed eastward a mere thread of silver on the darkening landscape, and the lofty mountains of the panorama in front seemed dwarfed by comparison in their proportions. Bright sunlight shone above, while the shades of evening were gathering on the lands beneath. These shades continued to deepen as the sun dipped lower on the horizon, until at length the darkness of night set in on the plains, while the upper regions of the mountain were still clothed in light. As long as light lingered in the western sky, the vast shadow of the mountain was to be seen stretching far away eastward, and clearly defining its form on the distant horizon.

The fine weather of the day did not change when darkness set in, and glorious was the sight when through the clear ether the hosts of heaven shone forth with a brilliancy and living lustre that almost dazzled the eyes. Far above the reach of lowland exhalations and in a highly-rarefied atmosphere one almost feels the presence of the heavenly bodies. Our two friends felt all the influence of this glorious sky, and of the position in which they were. Behind them was the snow-clad peak of the ancient mountain, carved, as it were, out of the dark sky. In front was the lesser mountain, regular in outline and symmetrical in form. There are many who believe that the Aghri Dagh of Armenia is identical with the Mount Ararat of Holy Writ—others again affirm, and not without strong reasons, that on the subsidence of the Flood the Ark rested on Ghibil Indi, a mountain of Kurdistan. Without pretending to weigh the merits of these conflicting opinions we may observe that the popular belief throughout Central Asia is favourable to the former. The Kurdish tribes who dwell on the slopes and at the base of the Aghri Dagh, and whose forefathers have been there since the earliest dawn of history, the native Christians of Georgia and Armenia—all indeed who preserve the traditions of the land—are familiar with the story of the Deluge. Their account of that great event varies but slightly from that which has been transmitted to us by Moses, and they hold it as part of their faith that Noah's Ark rested on Aghri Dagh, that the hull still remains on the summit deeply buried out of sight, and investing with a sacred character the place thus chosen to be, as it were, the second cradle of the human race, they believe that to scale the mountain is not only impossible, but that any attempt of the kind would be followed with the immediate displeasure of Heaven. The failure, often disastrous, which, as they allege, had attended all such previous attempts were well calculated to strengthen this belief. They have a distinct knowledge of every visit made to the mountain by adventurous travellers within the last fifty years, and Iss-hak Bey furnished us with many interesting details of the dangers which some of them had run and of the accidents which befell them in vainly endeavouring to gain the summit. He remembered all about Parrott's attempt in 1829. Parrott tried on the north side, but signally failed. Nevertheless, he published an account of his expedition, in which he took credit for complete success. The description given by him of the top has been adopted by the editors of the 'Imperial Gazetteer,' viz.: "Top gently vaulted, nearly cruciform surface, about 200 paces in circuit, towards east this summit is connected by a flattish depression with another summit distant 397 yards."

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This description is confirmed by Professor Abich, who, acting under instructions from the Russian Government, made the attempt in 1845, and according to his published narrative, reached the summit with six companions on the 29th July.

Now, Iss-hak Bey had distinct knowledge of the particulars of Abich's expedition as well as of Parrott's, and pronounced it, like the rest, unsuccessful—of which, by the way, further proof will be given as we proceed. As to the description above given, it varies almost irreconcilably with the observations of every individual of the party whose successful performances we are now recording. The summit, as seen by them, is in the form of a scalene triangle, the base, which is on the eastern side, lying nearly due north and south, being about 100 yards in length, the perpendicular about 300 yards. The base forms a ridge with an elevation of 15 yards at the southern extremity, subsiding gradually towards the north where it merges with the level of the summit. The apex of the triangle is the highest point of the mountain; separated from it by a dip, 70 yards wide and 25 deep, is another point which attains very nearly the same height. The area of the triangle is level, or rather slightly concave, suggesting the idea of an extinct crater. Such is the summit of Mount Ararat according to the concurrent observations of our party; we leave to others the task of accounting for the discrepancies which exist on this subject between us and other writers. Hundreds of Kurds were eye-witnesses of our ascent. These same Kurds confidently assert the failure of the travellers whose names we have quoted and of all others by whom the attempt had been previously made. To their testimony we may add that of Mr. James Brant, who, from 1835 to 1855, filled the post of British Consul at Erzeroum. The accuracy and extent of this gentleman's information as a traveller, as a man of science, and observer of passing events, give great weight to whatsoever he may say on matters connected with Armenia.

In walking on the summit of Mount Ararat one sinks about midway to the knee in the snow, which is so fine and dry, that it does not adhere to or wet the boots; but it rises like dust to the wind, blinding the eyes and penetrating the clothes and pockets. The rocks on the sides of the mountain consist chiefly of trachyte porphyry, and the effects of strong volcanic action may be seen wheresoever the natural surface is exposed. There are deep gorges, precipitous cliffs, and ridges of broken rock, from which masses occasionally detach themselves and roll to the bottom, leaving deep furrows on the snow, over which they pass. There are two extinct craters on the eastern side of the mountain, just above the saddle, which connects it with Lesser Ararat: one on a level with the bridle-path, which communicates with that part of the mountain; the other a thousand feet higher, to reach which one must climb a steep incline formed of lava and scoria. Lava, scoria, and pumice have also been found in other parts of the mountain; and from an exposed spot near the summit, there is a strong sulphureous emanation; while the parts immediately adjacent are warm to the touch. We may observe, that on this spot are to be found particles of mica, some of which are as large as a kidney-bean. Here there had evidently been volcanic action, for the surface consisted chiefly of triturated scoria and other volcanic substances. It will be remembered that in July, 1840, there was a violent eruption, which seemed to issue from a large natural chasm on the north side. This eruption destroyed the ancient monastery of St. James, and buried in ruins the village of Arguri, situated more than 6000 feet above the level of the sea, and rendered venerable by the Armenian tradition, which indicates it as the place where Noah planted the vine after his descent from the mountain, Arguri signifying in the Armenian language, "the planting of the vine."

At length the first dawn of day appeared, that cold pale light that spreads

over the eastern horizon when the sky is clear of clouds and the atmosphere of vapours. Rising from their bed of stone, our travellers addressed themselves at once to the work before them, in high spirits at the prospect of continued fine weather. A few mouthfuls of unleavened bread served them for breakfast, for they decided, wisely, as we think, to trust as long as possible to the strength of the ample dinner they had made overnight, by which means the lungs would be less impeded in their functions; they would have more room to expand in the act of respiration, and the system would consequently suffer less from the effects of the rarefied air. Were this plan more generally adopted by mountain climbers, we should bear less of failures from apoplectic symptoms, such as difficulty of breathing, vertigo, blood rushing to the head and escaping through the ears and nostrils, all of which result from a full stomach, or from a fulness of habit, either chronic or temporary, which circumscribes the action of the lungs at a time when their utmost capacity is required to obtain a sufficient supply of oxygen from the rarefied atmosphere. Most healthy men possess a reserve of strength that will carry them through a heavy day's work without food. The stomach, especially in the case of persons accustomed to regular and generous diet, may rebel against this; but after the first few murmurings, it will settle down into a sullen acquiescence; and in such situations as we are now speaking of, the more vigorous action of the lungs will go far to supply what may be wanting.

Major Stuart and Mr. Thursby had soon full proof of the truth of these remarks. Quietly and steadily they moved upwards, making as little effort as possible, husbanding their forces, looking out the securest footing, and halting at frequent intervals. They climbed cat-like over difficult projections, or along the face of perpendicular escarpments, they hung to butting cliffs, traversed inclined sheets of ice as smooth as glass, and poised themselves on giddy pinnacles of rock. Hour after hour this laborious work continued, but, thanks to the system they had adopted, without producing fatigue, or sensibly taxing their strength.

They were marvellously aided, too, by their iron-tipped staves. The staff is to the mountain climber what the oar is to the Laplander, the helm to the ship, the break to a carriage. It helps him in all his movements, ascending and descending. If he makes a false step, it enables him to recover himself. Is the incline difficult it serves the ascent as an extra limb of ten-leg power, on the descent as a drag or lever; does he fancy a glissade down the snow, with it he steers his course, checks or modifies his speed, or brings to at pleasure. In fact its uses are so varied, and so applicable to every situation, that it must be considered an indispensable part of the mountain traveller's equipment.

On a rocky spot, about 1200 feet from the summit, and under the western lee of a high mural ridge, is a cross, which records the expedition of Professor Abich in 1845. It is made of oak, the upright being 7 feet above ground, the transverse bar 3 feet in length, and it is firmly wedged in between two large masses of rock that lie close to each other. From the action of the weather the surface of the wood has become so soft that it may be scraped off with the nail of the finger to the depth of one-eighth of an inch. On a brass plate 6 inches by 4, screwed on at the inter-section of the bars, is engraved in Russian the professor's name, and the date of his ascent. Several mutton-bones, partially decomposed, lie about at the foot of the cross, and a kama or short Turkish sword, which was in very fair preservation, the blade, though without a scabbard, having suffered but little from rust. Major Stuart took possession of this kama, and should any future traveller reach the summit of Mount Ararat he may, perhaps, find it on the highest point, where the Major stuck it arm-deep into the snow.

With respect to this cross, it may be asked why Abich planted it so far

down from the summit, if, as he asserts, he and his party reached the highest point? It would have been easy to have found as secure a position anywhere up to 1000 feet higher.

About 9 o'clock A.M. our friends had the satisfaction of gaining the highest point of the mountain, and with hearts brimful of loyalty, and somewhat elated by the occasion, they drank their Sovereign's health, as the fittest mode of giving expression to their feelings.

After spending nearly an hour on the summit, they addressed themselves to the somewhat nervous task of descending. The soles of their boots had been much worn away and smoothed by the ascent, but, by keeping to the tracks of the party that preceded them, and by the assistance of their faithful staves, they were enabled to tread their way in safety down the icy shoulder of the mountain. Arrived at that level where the snow is softer and more practicable, they abandoned the slow work of the feet, and, trusting to the glissade, they reached the foot of the cone about 12 o'clock. They had spent twenty hours in the regions of eternal snow, in the course of which, besides attaining the object of their expedition, they saw the sun set and rise with such glory and splendour as can be witnessed only from an elevation of 13,000 feet.

Pursuing their way towards the tents, they found horses awaiting them at the nearest practicable spot. The Kurdish messengers held their stirrups with profound reverence as they mounted, and as they approached the upper encampment, its occupants, old, young, and middle-aged, turned out to look on those strange English Beys, who, as they all had seen with their own eyes, had scaled the forbidden mountain. Milk of kine in all its forms was brought forth for their refreshment, and a sort of triumphal procession accompanied them nearly the whole way to the tent of Iss-hak Bey, where they arrived at 3 o'clock P.M. They were received by the Bey with many complimentary speeches, and after a cordial greeting from their "*compagnons de voyage*," the remainder of the afternoon was devoted to comparing notes. Dinner was served at sunset, and, as may be supposed, every resource of the encampment was put in requisition to make it as *recherché* as possible. The fattest sheep and the fattest kid had been slaughtered, for the Kurds know as well as the English that there is no way of honouring a guest more effectually than by a good dinner. Until a late hour the door of the tent was blocked up by Kurds, old and young, who were anxious to see with their eyes and hear with their ears the wonderful Beys of the mountain; for they no longer looked upon them as ordinary men, but as beings of a superior order, who could not be affected by the religious restrictions imposed upon themselves, and who were not subject to the physical infirmities of other men.

In now bidding adieu to the ancient mountain, we may observe that, owing to the suddenness and uncertainty of atmospheric changes on its higher levels, and the violent agitations of the elements about its summit, even at times when all is calm below, the only time of the year when it can be visited with safety is in the months of July and August, when, comparatively speaking, settled, fine weather usually prevails in these regions.

After a night of profound sleep, our party rose on the morning of the 15th, oblivious of fatigue and ready for any other enterprise that might be proposed. It was, therefore, carried by a majority of votes that that day should be devoted to the ascent of Lesser Ararat. Major Fraser and Mr. Thursby did not feel disposed to join in this expedition. Accordingly, after breakfast, the other three set out on horseback, accompanied by Iss-hak Bey and the *zaptieh* with two or three attendants on foot to take charge of our cattle. A rough ride of two hours over mountainous ground that had been torn up, scarred and distorted by old volcanic action, brought them to that part of Lesser Ararat situated above the saddle which unites the two mountains where horses are no longer available. Thence to the summit the perpen-

dicular height is between 3000 and 4000 feet, and as the plane of the ascent is nearly even, and the surface, which is a loose gravel, affords a good foothold, they succeeded in reaching the highest point after about three hours' work.

The Lesser Ararat exhibits no traces of volcanic agency, but the effects of violent storms are visible in the nakedness of the rocks which crest the summit; all covering of clay or soil has been swept from them, and in many places they are vitrified on the surface and pierced with lightning-tubes, thus showing with what force electric storms prevail in these elevated regions.

The winter snows, with the exception of a few patches in sheltered places, are thawed on Lesser Ararat in the course of the summer, and on the occasion of which we are speaking, the air was as soft and still as it is on a May day in England. The summit, which appears from the plain to be a symmetrical finish to this beautifully-formed mountain, is concave, of irregular shape, and measures in the widest part about 60 paces. The concavity must at one period have formed nearly a complete shell; but on the south-west side nearly one-third of the rim has given way, following a land-slip which has formed a deep cleft extending many hundred feet down the mountain-side. The débris is now spread out over a considerable surface on the lower slopes.

The highest point of Lesser Ararat is a little rocky eminence that crowns the eastern flank. Here, within the compass of a few square yards, the three great empires of Russia, Turkey, and Persia come in contact. The boundary line between Turkey and Persia strikes thence nearly due south, that between Russia and Turkey due east, dividing the peak of greater Ararat, and thus securing one-half of the mountain to the empire of the Czar. There was a deep meaning in the policy which insisted upon the acquisition of a part of this mountain. It was not for the sake of the territory, for that is intrinsically valueless, nor had it reference to any military advantage, for the locality offers none; but it was in order to obtain a hold upon the religious feelings of the inhabitants of those countries, which, as we have endeavoured to show, attach themselves strongly to Mount Ararat. It was part of that policy which appropriated Uthmiadzin, the Rome of the Armenian Church, and the residence of its visible head—who thenceforward became a Russian subject.

The descent from the lesser mountain was easy and expeditious, indeed two of the party performed the greater part of it at a running pace, for the gravel yielding slightly at every step assists the descent while it prevents the possibility of a dangerous speed. Here, too, we started a family of the mountain ibex which was wandering about, Heaven knows in search of what, near the summit; perhaps they seek those places difficult of access in order to be removed as far as possible out of the reach of their enemies. The ascent of Lesser Ararat is but an ordinary feat, and is frequently performed by the young Kurds for a day's amusement; but as a pendant to what had been already done, it served to give a finish to the expedition. Of more importance, however, than this is the fact that from the summit of the lesser mountain, and perhaps from no other point, the spectator is enabled to judge of the vast dimensions and symmetrical form of the greater mountain. Seen from thence, all its irregularities of surface disappear, its whole outline is taken in from base to summit on the northern and southern sides, and the huge mass presents itself to the eye as regular in form as the great pyramid of Egypt, but far more beautiful in shape. We may also add that perhaps from no other eminence on earth is a vaster or more interesting view to be obtained. On a clear day the eye can range over the three empires of Russia, Turkey, and Persia, until the sight is fairly lost in distance. The panorama is bounded only by the power of vision.

Iss-hak Bey was in high spirits as the party rode back from the foot of the

mountain to the tents. At times he would strike up one of the war-songs of his clan, exercising the full power of a voice, by no means unmusical, in giving effect to the wild and inspiring notes. Inspired by his own performances, he would dash off at full speed whenever a suitable piece of ground offered, and, as if engaged with an enemy, go through all the evolutions of their peculiar mode of fighting, charging, retreating, wheeling short round as if on a pivot, shouting and yelling, until both man and horse seemed warmed up almost to the feelings of reality. The manœuvres were certainly very pretty to look at, and would, no doubt, tell well against such enemies as the Kurds have to deal with.

Early on the morning of the 16th preparations were commenced for the return to Bayazid. A breakfast in the highest style of Kurdish cooking was got ready betimes; milk, new and clotted, mutton, roast and boiled, and fresh chupaties in abundance, all hot and smoking from the embers; then came coffee and pipes, after which the zaptieh announced that all was in readiness. The cavalcade set out, headed, as usual, by the Bey, who was mounted on his favourite mare, equipped in all the finery of gay clothes and cumbrous arms. Retracing their previous steps, they descended the mountain, crossed the plain, and arrived at Bayazid about midday, when the whole party was again honoured with a reception by the Vaali. He congratulated the English gentlemen on their achievement, adding that it would be his duty to make a special report on the subject without delay to his Government. He probably attributed the expedition to some secret motives of policy or espionage, for the Turk is slow in believing that a man in the enjoyment of his senses will expose himself to difficulties and dangers from the mere love of adventure.

Be that, however, as it may, it is now registered among the State archives at Constantinople that in August, 1856, five English gentlemen succeeded in reaching the highest point of Mount Ararat.

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PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED MARCH 6TH, 1877.]

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SESSION 1876-7.

*Third Meeting, Tuesday, 12th December, 1876.*

HIS ROYAL HIGHNESS the PRINCE OF WALES, K.G., VICE-PATRON,  
in the Chair.

ELECTIONS :—*Honorary Member.* His Majesty Dom Luis I., King  
of Portugal.

The following were also elected Fellows :—

*David Alfred Aird, Esq.; Surg.-Major A. F. Bradshaw; Rt. Hon. Sir Baliol Brett; Robert Alexander Brooks; Algernon C. P. Coote, Esq., M.A.; Henry J. Dore, Esq.; John T. Fitz-Adam, Esq.; Lieut. T. A. Fox, R.N.R.; Archibald Gray, Esq.; Joseph Grierson, Esq.; Rev. Joshua Hawkins; Sir John Hawkshaw, C.E.; Robert Headley, Esq.; Thomas Horsley, Esq.; J. P. Joaquim, Esq.; Alfred William Lafone, Esq.; B. W. Levy, Esq.; Major-General Henry Edward Longden, C.B.; Rev. D. Stuart McClean; Donald Macfarlane, Esq.; Joseph Charles Mappin, Esq.; George Mathews, Esq.; John G. Meiggs, Esq.; Foster Mortimore, Esq.; Lieut. T. G. Murray, R.A.; Frank Normandy, Esq.; Rev. Charles John Ridgeway; William Newland Rudge, Esq.; Thomas Russell, Esq.; George Sibley, Esq., C.E.; James Dickson Steele, Esq.; H. Stewart, Esq.; Rev. M. C. T. Sturman, B.A.; Hon. Hamilton Tollenmache; William Tufnell, Esq.; C. C. Williams, Esq.; John Williams, Esq.*

DONATIONS TO THE LIBRARY, 27TH NOVEMBER TO 11TH DECEMBER, 1876.—The Encyclopædia Britannica, 9th edn. vol. v. (*Messrs. A. and C. Black*). Notes on the history and antiquities of Chaul and Bassein, by J. Gerson Da Cunha; Bombay, 1876 (*Author*).

Descriptive notes on Papuan plants, i.-iii., by F. von Mueller; Melbourne, 1875 (*Author*). Le Déplacement Polaire, par Jules Carret; Paris, 1877 (*Author*). Census of the British Isles, 1871; the birth-places of the people and laws of migration, by E. G. Ravenstein, 1876 (*Author*). List of principal tea-districts in China, and Notes on the names applied to various kinds of black and green tea, by H. G. Hollingworth; Shanghai, 1876 (*Author*). Journal of the North-China Branch of the Royal Asiatic Society, new ser. x. (*H. G. Hollingworth, Esq.*). Report of permanent Committee of first International Congress at Vienna: Meeting at London, 1876 (*The Meteorological Committee*). The 'Challenger' Expedition. Hydrographic Proceedings, No. 7; and Papers by Sir Wyville Thomson and others communicated to the Royal Society, 1876; also, the 'Valorous' Expedition, Papers by Dr. Gwyn Jeffreys and Dr. Carpenter, from Proceedings of the Royal Society, 1876 (*The Lords Commissioners of the Admiralty*). Report by Sir B. Robertson respecting his visit to Haiphong and Hanoi in Tonquin, 1876 (*J. V. H. Irwin, Esq.*). Histoire de l'île de La Trinidad sous le gouvernement Espagnol, Pt. 1, par P. G. L. Borde; Paris, 1876 (*P. N. Bernard, Esq.*). De Residentie-Kaarten van Java en Madoera, door F. de Bas; Amsterdam, 1876 (*The Netherlands Geographical Society*). Versuch zur Aufstellung einer Uebersicht der Schweizerischen Stromabflussmenger, &c., von R. Lauterburg; Bern, 1876 (*Author*). Address on thermal paths to the pole, by S. Bent; St. Louis, 1872 (*Author*). Statistical Register of Victoria for 1875, pt. v. (*The Victorian Government*). Two large Albums of photographic views of Adelaide and vicinity, S. Australia (*The Chief Secretary, S. Australian Government, per J. Boothby, Esq., Under Sec.*), and the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM NOVEMBER 13TH TO DECEMBER 11TH, 1876.—Map of South Africa, constructed by Mr. H. Hall (*S. W. Silver and Co., Publishers*). 3 sheets of Admiralty Charts (*Hydrographic Office*). Map of Western Australia, showing Explorations made between the years 1872-6, 3 copies. Map of Persia, by Capt. O. B. C. St. John, R.E., six sheets. Map of the Nile between Magungo and Shoa Moru, by S. E. General Gordon-Pacha, August, 1876; Map of route from El Obeyad to El Facher, by Commandant Prout; Map of Gebel Marrah, Darfour, by Commandant Prout (*Gen. Stone, Chief of the General Staff, Cairo*).

In order to provide more space for the large number of Fellows and their friends expected to attend the present Meeting, to welcome the Commander and

officers of the Arctic Expedition, the Council found it necessary to engage St. James's Hall for the occasion; the Meeting being held on Tuesday the 12th, instead of the usual day, Monday the 11th. His Royal Highness the Prince of Wales had previously signified his intention of being present and taking the Chair.

The PRESIDENT (Sir RUTHERFORD ALCOCK) spoke as follows:—Your Royal Highness, my lords, ladies and gentlemen, we are to be congratulated this evening that your Royal Highness has been pleased to associate yourself with the Geographical Society in rendering honour to those who, amidst many perils and singular trials, have done their best to reflect honour and credit on the service and the country which claimed them. We are met here this evening for a twofold object. The first is to give that welcome, which they have so richly earned, to the officers of the *Alert* and *Discovery*; and secondly, to hear from their own lips some account of their experiences and their strange trials and adventures in that unknown region, the North Polar Sea. We have all, no doubt, read with great interest the official report which has been published of Sir George Nares, the Commander of the Expedition, but that I consider to be a mere skeleton of what they have to tell us whenever the opportunity is afforded them; it is but the dry bones, which they have to bring to life and to clothe with living words before we can thoroughly enter into the great and important service which they have rendered, and appreciate the noble spirit in which they performed their duty. We shall be favoured to-night with an account from three of the senior officers. Captain Sir George Nares will read a paper on the North Circumpolar Sea; Captain Stephenson will read another upon the winter experiences in the *Discovery*; and Captain Markham will give us some account of the Arctic Sledge Travelling. Those papers will no doubt fill up the whole of our time, and the truth is that it is not the extent of Geographical discovery nor the scientific results that most deeply touches the popular mind at this moment. It is the high qualities that have been displayed by these representatives of our British Navy, and their powers of endurance, unflagging courage, and never-failing spirit of generous emulation, which have touched the best chords of our hearts, and these are the things which we come now to congratulate them on having so successfully displayed. There are many kinds of heroism, and many degrees of courage. We are, perhaps, too much in the habit of associating the word "hero" or "heroism" with the battle-field, the storm, and the fight that takes place either between bodies of men on shore or ships at sea; but I think very few will have read through this bare narrative, unfilled up as it is, of the hairbreadth escapes, of the constant perils, of the marvellous adventures that these ships and the sledge parties have incurred, without feeling that it is a great mistake to limit heroism to the mere carrying of a flag through storm and peril to victory. These Arctic ships had to be navigated among great ice-floes 20 or 30 feet thick; and as Sir George Nares has well described, if two of these ice-floes clip a ship between them it is crushed like a nut. They are like great blades of some supernatural shears. There is no human force that can possibly resist them. And then if you consider the sledge journeys, nothing more marvellous has ever been related. I say nothing of the long night of 142 days, of the lowness of the temperature where 60 degrees below zero has been reached, and where men had to live, and to work, and to plough through the snow, under this intense cold; but these sledge journeys I venture to say have never been paralleled, take them altogether, either in what they achieved or in the dangers and perils they have confronted with the most perfect spirit, without once flagging, even though disease struck many of them down. One incident alone will tell you much. They had to pass a night on one range of hills where the cold was so cruel that they named the place "Frost-bite Range." Fancy



having to travel through a range of snow-clad mountains and icebergs that was characteristically named Frost-bite Range! There was one heroic event among many which was marked in a very few lines by Captain Nares with the due meed of praise, though he was of course anxious not to single out one as deserving more than another, for there has been nothing more gratifying, nothing that reflects more honour and credit upon them and the country, than the generous emulation, the absence of all possible jealousy or rivalry except in the finest and the highest spirit. The sledge party commanded by Captain Markham, after making one of the most extraordinary passages north over the frozen sea, and over great hummocks of ice through which they had to cut their way, making only 2 miles a day, but having to go over the same distance five times, were at last struck down with fatigue and disease; and when they were 30 miles from the ship, with five of their companions laid helpless on the sledges to be dragged, it was clear that there was no power in human sinew and courage to carry their sledges further. Lieutenant Parr then struck out on a lonely walk. He felt he had the courage; he believed he had the physical power, and he knew that he would not fail in anything short of that; and he set off on his 30-mile walk, blinded with snow, over the ice tracts, with nothing better often to guide him than the track of a wild wolf that had been travelling backwards and forwards between the spots where they had rested on their road; and at the end of 22 hours, without rest or sleep, he arrived at the ship in time to send succour and save the lives of his party. I know of nothing more heroic in the annals of war or travel than that solitary walk of 30 miles. You are no doubt all anxious to hear from the travellers themselves their account of these experiences. I merely venture to say these few words because I know that this great assembly is not here without feeling the deepest sympathy, and the most earnest desire to give them the hearty welcome that they have so nobly earned.

Captain Sir GEORGE NARES: On the part of the Arctic officers I thank you, and in fact the whole of England, for our welcome home. Few words are the best, and I can only say we thank you with true English thanks. After such a speech as we have heard from Sir Rutherford Alcock in connection with the Expedition, it is due to both officers and men to say that Lieutenant, now Captain, Parr's walk was only one out of numerous deeds of heroism which I in my official Report could not enter into.

The following Papers were then read:—

1.—*On the North Circumpolar Sea.* By Captain Sir GEORGE S.

NARES, R.N., K.C.B.

TIME will not permit me to do more than glance at the most important increase of practical knowledge concerning the Polar area which has been acquired during the late Arctic Expedition, and which has not been touched upon in my official Report. I do not pretend to state new facts or start new theories—I merely place before you in a simple form what we have gleaned from Nature and from published works.

As a check on our statements, I may mention that upwards of a hundred photographs have been brought home by the Expedition; these, representing the exact characteristics of Arctic ice, are now being printed. Besides forming a decided point of refer-

ence for the future, they may be accepted as Nature's own report, which cannot possibly be garbled or put on one side.

In order to explain my subject as clearly as possible, I have thought it best to direct your thoughts for a few minutes to the warmer parts of the earth. For the condition of the Polar area is dependent to a very great degree on the present distribution of land about the Equator.

The sea is a great distributor of heat. The too well-known trade-winds, blowing across the warm tropical seas from the eastward, and as they approach the Equator gradually changing their course more towards the northward and southward until they may almost be said to meet, by the constant and never-ending pressure which they exert on the ocean-surface, accumulate a head of water in front of any obstruction to their course, and this flows naturally away towards the point or points of least resistance. Owing to the vast length of America, stretching as it does from north to south, and forming a natural breakwater, lying not only directly at right angles to the pressure of this water, but the contour of the coast-line being the most appropriate for the purpose, the head of water, collected near the Equator from both the north and the south tropics, and pressed forwards against the eastern shores, is guided off mostly into the North Atlantic, only a comparatively small quantity flowing towards the south along the Brazilian coast.

In the Pacific Ocean, at present, owing to the gaps in the natural breakwater at the most vital point between Australia and Asia, and to other causes foreign to our present subject, the water, not finding a similar barrier to its course, is not turned aside to an equal extent, and the overflow towards the north or south is not so powerful.

To return then to the Atlantic Ocean. As discovered and accurately measured by the members of the *Challenger* Expedition, it is a fact that an enormous reservoir of heat exists there, peculiar to that ocean alone; that is, a film of warm water, upwards of 1000 feet in depth, and heated above the temperature of the water situated in corresponding latitudes in the Pacific and in the Southern seas, where the distribution of land and sea is so totally different, a film of heated water is floating like oil over a considerable portion of the sea above the colder water, which would exist there alone were it not for the friendly breakwater. This warm water—held, as it were, in a pocket—is forced by a continued influx to spread itself gradually towards the northward and eastward, modifying the climate of all parts lying in its course.

There is also a warm current ever running to the northward

through Behring's Straits; but that channel is so narrow, and also so shallow that it need scarcely be introduced into the present discussion.

We have, therefore, for our present consideration a warm body of water flowing towards Spitzbergen into the closed-up North Polar Basin. A considerable body of warm water also finds its way north along the west shore of Greenland on the east side of Baffin's Bay.

Such a quantity cannot be continually flowing into an enclosed space without pouring over its borders or running out elsewhere. Accordingly, we find that in all the other channels, except those mentioned, an icy-cold surface-current is overflowing and running to the southward.

The rate of the two principal ones drifting towards the south—along the east coast of Greenland and down the west side of Baffin's Bay—have been accurately measured. The first, owing to the extreme hardships so manfully borne and battled with by the crew of the *Hansa*, of the German Arctic Expedition, as they drifted slowly but continually to the southward on one of the heavy Paleocrystic floes, after their ship had been crushed by the ice, leaving them at the commencement of winter without any other resource. In 235 anxiously-spent days, between September and May, they drifted no less than 950 miles at the rate of slightly more than 4 miles a day. Abandoning their icy raft, which was then much reduced in size, they reached by means of the boats one of the Danish settlements near the south point of Greenland.

It is perhaps necessary for me to state that the velocity of 4 miles a day is, I believe, only to be found south of lat.  $75^{\circ}$  or  $76^{\circ}$ , where a stronger current, coming from the north-east, unites with the Greenland current.

The more widely-known drift of part of the crew of the *Polaris*, on a similar floe of ice, from the entrance of Smith Sound to the southward—when in 166 days, passed in a state of semi-starvation, they drifted 740 miles (much about the same rate), measured the strength of the other current. From these two drifts we may, for practical purposes, consider the southerly outflow of ice from the Arctic Sea to be not more than at the rate of about 4 miles a day.

We are now considering the Polar Basin as a locked-up bay, continuing out of the narrowed North Atlantic channel, with a warm stream of water constantly pouring into it between Spitzbergen and Norway, and a cold icy one as constantly running out between Spitzbergen and Greenland, and also through the many narrow straits between Greenland and America; the first conveying an

enormous source of heat towards the north, the latter helping to produce the intense cold of Canada and that on the east coast of Greenland and North America.

So great is the difference in climate caused by these two powerful distributors of heat and cold, that the temperature of the sea on the American coast, on the border of the cold current, 2200 miles from the Equator, is precisely the same during the summer as that midway between Spitzbergen and Norway, in lat.  $70^{\circ}$ , at nearly double the distance from the Equator.

The inhabitants at New York, if they wish to bathe in the sea, have actually to plunge into water of the same temperature as that off the north coast of Norway.

In the Polar Sea, near the inflow of the warm water, we would naturally expect to meet the lightest ice and an early season, near the outlets the heaviest ice; and such is found to be the case. Previous to the late voyage, the heaviest known ice was that drifting to the southward along the east coast of Greenland, which, owing to its great thickness, is able effectually to battle with the decaying influence of the warmer water and climate it meets with in the southern regions, as it drifts onward towards and round Cape Farewell.

The same kind of ice has been traced all the way from Behrings' Straits eastward to Banks's Land, and from there west of Prince Patrick Island to Ireland's Eye, from which point it is lost; for the sledging-parties under Admirals Richards and Osborn, journeying along the north shores of the Parry Islands, found light ice. We therefore conclude with certainty that some protecting land exists to the northward.

Pushing our way north in the *Alert* and *Discovery*, towards the entrance of Robeson Channel, we gradually realised that we could not be far from the same sea which gives birth to the heavy East Greenland and to the western ice.

When fixed behind our friendly barrier of floe-bearers, which by the blessing of Providence protected us so well against the heavy ice, during our long but cheerfully-spent winter, with the land trending away eastward and westward towards the other known neighbourhoods in which it had been found, and, so long as the ice continued in motion a slow but constant flow towards the east, we could no longer doubt that we had arrived at the boundary of the Polar Sea. From our winter-quarters, the heavy Polar ice was traced by Lieutenant Aldrich for one-third of the distance towards Ireland's Eye, leaving 400 miles still unknown to the westward. Lieutenant Beaumont proved that it extends for 100 miles to the eastward,

leaving about 500 miles still unexplored between his farthest and the farthest of the Greenland Arctic Expedition under Koldewey.

Owing to the similarity of the tides at our position and along the shores of North America, the direction of the prevailing winds, and the nature and movements of the ice, I am tolerably confident that the land west of our explorations trends towards the south-west. I have also reason to suppose that the Greenland coast does not extend much farther north beyond the latitude to which it has been traced. This is, of course, merely a theoretical statement; but I am not led to this belief by the common plan of drawing in fancy coast-lines.

We have now a distinct knowledge of the nature of the ice in the Polar Sea. Whether that sea—on the border of which we remained for eleven months—extends to the Pole, or across the Pole, we cannot be absolutely certain; but by reasoning, we may safely predict that a very broad opening exists north of Cape Columbia; and I have reason to believe that it extends at least as far as the Pole. We are certain that there is a large sea, and that that sea is covered with ice during the winter. We also know that in the summer, in consequence of the melting of the ice in front of the large rivers which drain the warm water from the plains of Asia and America, and other causes, the ice becomes subject to motion by the winds and currents, and gradually breaks up into fields and floes, which are ever decreasing in size as the season advances. Curiously enough, so far as I have yet had time to examine, although the snow melts and evaporates in May and June, the ravines and rivers burst forth with the summer thaw simultaneously all over the Arctic area north of latitude  $70^{\circ}$  within a very few days of the 1st of July. Soon after the first week in July, the whole pack of ice commences to drive backwards and forwards, according to the wind or current, its main course being towards the channel of outlet; it there escapes in small quantities out of the Polar Basin. Gaining more room as the season advances, the pack itself gradually breaks up, when any space left vacant is immediately occupied by the contending masses, each field and floe struggling and forcing its way to gain a clearer space. Wherever the angular corners of any of these fields meet, small pools of water are formed for the moment; but unless these are continuous and connected together by channels (which can never possibly be the case), they are not navigable. This state of things continues from July to the end of September; after that date the increasing frost gradually cements together the contending masses, until by the end of October the whole sea is quiet again, the

ice only cracking occasionally with the tidal currents in narrow channels, and in parallel lines close to the shore. Wherever a pool of water existed during the autumn, there the winter's ice forms to about  $7\frac{1}{2}$  feet in thickness. In the summer, this being the weakest part of the pack, it yields most readily, and there the ice breaks up in the early season. We must also consider that a constant new formation of ice is taking place for at least seven months in the year, which more than equals the decay taking place during the other five. The icy covering on the Polar Sea must therefore be considered as stationary only during the winter. Near Floeberg Beach, for a short three months of summer, it moved towards the eastward with spring-tides, at an estimated speed of about one mile a day, but more slowly during the neap-tides. During the winter only, are the heavy fields or floes frozen together with a cemented border of encircling broken-up ice. This rubble ice, as we call it, when any severe pressure comes in the summer, breaks away from the heavy, deeper-floating fields of somewhat smoother ice, as eddy currents or winds wrench the latter clear from the surrounding rubble. Thus the pack covering the Polar Sea is a collection of separate pieces of ice, movable amongst each other during the summer, like the boulders and pebbles in a river-bed, each piece grinding against its neighbour as the whole body jostles its way along, slowly pressing forward towards the outlet between Spitzbergen and Greenland. It must thus be understood that the roadway made, with such labour, over the pressed-up ice by the northern travellers under Markham and Parr, broke up and drifted away shortly after their return, and is now no longer available for those who wish to follow in their footsteps.

The formation of the heavy ice in the Polar Sea, and its unusual thickness, is by no means a new discovery.

I have already reported that it was met by many of our predecessors; however, none of these had so good an opportunity of studying it as we had, in consequence of our wintering actually amongst it. Whatever quantity of land may hereafter be discovered, we may safely assume the area of the Polar Sea as being from one to one and a half million square miles. The principal outlet between Greenland and Spitzbergen is slightly more than 300 miles broad, but only the western half of this channel is really used by the south-running current bearing the heavy Polar ice. If we suppose the whole channel to be used, and the ice to be drifting all the year, instead of for only three or four summer months, even then the outpour of ice, at the rate of 4 miles daily, would give less than half a million of square miles of ice as being

able to escape. Thus from a half to two-thirds of the total quantity is left behind. This is a very rough calculation, but it is sufficient to show that there must be an accumulation.

A nearer calculation, based on the slower rate of progression of the ice in the neighbourhood of our winter quarters, 500 miles to the north-west of the mouth of the outlet, would give less than one-hundredth part of the total quantity of ice as being able to escape through the western half of the channel, and therefore for a considerable part of that left behind to be at least 100 years old. But even this is very far from what must actually be the case, for its great thickness proves that a very small proportion can be carried away yearly.

North-west of Floeberg Beach, owing to a continuous pressure from the north-westward, the pack-ice never succeeded in moving off away from the shore, even during the strongest gales, as it does in other regions, consequently there is no opportunity of passing along the land towards the east or westward in the usual manner. In that neighbourhood a current, or heavy pressure from behind, forces the pack-ice against the southern shore of the Polar ocean.

All the drift-wood which was found at the northern entrance of Robeson Channel was found in bays open towards the west, never in bays open towards the east.

I will now glance for a few moments at what we learn from the Austrian Expedition. We know that they drifted from Nova Zembla first to the north-east, and then to the west, to Franz Joseph Land, and finally that the ice in which they were frozen in became stationary off the south coast of that land. In that position the prevailing winds were from the eastward—a totally different direction from those at Floeberg Beach. But this we should expect. The currents of air should flow from the cold area around the Pole towards the warm sea, open even during the winter to the south of Spitzbergen.

The most remarkable fact ascertained during their voyage is, in my opinion, the finding channels of water, and large flocks of sea-birds on the shores of Austria Sound so early in the season as the first week of April—a very unusual state of things. This I can only account for by supposing the existence of a narrow channel, with a strong current of water running through it, and the non-existence of other large openings in the neighbourhood. This, again, leads us to conclude that the land must be nearly continuous between Spitzbergen and Franz Joseph Land, and that the latter extends some distance farther towards the eastward.

The fact that the ice accumulates in large quantities on the east

coast of Spitzbergen, with a strong current setting to the west past the South Cape, and the total absence of ice on the west coast, would also lead us to conclude that it cannot escape in large quantities to the northwards, in consequence either of nearly continuous land, or from meeting a strong current setting from the north-east. Whatever is the cause, the region between Spitzbergen and Franz Joseph Land has now become a most interesting neighbourhood for exploration; but with the warning of the necessary abandonment of the *Tegethoff* it must not be undertaken without due caution being observed. The investigation of the extreme depth of the bight in the Barents Sea towards the north is most interesting, and may lead to the establishment of an important fishing-station.

We can now account for the frequent opening in the ice off the east coast of Greenland in the 75th parallel of latitude. The quick-running current from the eastward, passing the north and south points of Spitzbergen, keeps on its course towards the Greenland coast, and there, blending with the slower-moving Polar current, sweeps the ice forward towards the South from the main pack; more particularly during the winter and the early summer months when the Polar pack is stationary, and before it has commenced to break up.

From the cold weather at Floeberg Beach always coming with north-west winds, and the fact that, for a long period after the ice has stopped drifting elsewhere, pools and cracks of water existed at the north of Robeson Channel, from which the escaping heat materially modifies the temperature of the neighbourhood, we argue that a colder area existed towards the north-west. But of this I do not wish to speak with more distinctness until the meteorological observations of the two ships are carefully compared, which I have not yet had time to do. The observations made on board the *Discovery*, and the report compiled with so much ability by Dr. Ninnis, are more than usually complete. The gales felt in the Arctic Sea can be readily traced to remote regions.

From our observation and experience we may reason with confidence, that if land exists at the Pole it would be vegetated, and that birds would migrate to it to escape as far as possible from their many enemies. The distance of 400 miles can scarcely be considered too far for their flight. The fact of their not migrating to the northward may be taken as conclusive proof that no land exists for a long distance in that direction, or that there are narrower channels affording the birds a shorter flight between it and other lands, near the Asiatic shore.

Without trespassing far into Captain Feilden's department as



naturalist to the Expedition, I may state that the absence of icebergs does not, as is generally supposed, necessarily prove that no land exists. Glaciers depend upon the excess of precipitation over evaporation and the summer thaw. Given a *light* snow-fall, land can exist in a cold region without glaciers forming on its surface. Glaciers grow to the maximum extent on cold lands washed by warm seas; there the high mountains condense the moisture from the atmosphere.

The North-polar area may be said to be guarded from a heavy snow-fall. At Floeberg Beach none of the glaciers reach the sea. The greater part of the moist air travelling up from the southward descends as snow on the slopes of the high lands to the southward, where it meets the first cold region. Consequently at the north the precipitation is at a minimum, and we need not expect to find discharging glaciers or icebergs in any sea cut off from warm currents. There is also another consideration. In a deep valley in low latitudes, protected from the sun's rays, snow collected in the shade will remain unmelted for a considerable time. But as we advance towards the Poles there is no such thing as a valley perfectly protected from the rays of the sun, for as the sun continues its course at a high altitude above the horizon at some one time of the 24 hours, whether at noon or what is here called midnight, its heat-rays exercise their power and melt the snow.

I may here allude to one interesting fact which I regret there is not time to dwell upon at large. During the very many friendly discussions which used to take place on board the *Challenger* between my colleague, Sir Wyville Thomson, and myself, I never quite gave in to his opinion that at the South Pole the precipitation was greatly in excess of evaporation. Now I believe him to have been perfectly right, for I believe that the snow never thaws there even during the summer. An iceberg appears much the same in both the northern and southern seas to a casual observer, but there are not many who have had the opportunity of being able to study both. In the Southern Seas each season's layer of snow can be readily traced on the broken-off icebergs, appearing as fine layers of stratification very like the circling rings denoting the age of a tree. These are totally absent in a northern iceberg. I consider that this difference is due to the snow-deposit in the cold southern area never being thawed, even during summer, while in the northern regions, where the influence of the heat-rays of the sun are supplemented by the equally important warmth-giving water, the heat is sufficiently powerful to transform the season's snow-deposit into nearly consistent ice.

In all previous British expeditions the winds have been much more variable than they were at Floeberg Beach, consequently the surface of the snow-drifts was harder, and afforded good travelling. Whenever snow falls in sheltered regions where it is not exposed to a strong wind, it remains soft and unable to support much weight. During the late Expedition, and Koldewey's, on the east coast of Greenland, much softer snow had to be travelled over by the sledge parties than had before been experienced, and snow-shoes were necessarily much more commonly used. For the future all Arctic ships should be supplied with them, but the difficulty will still remain of how to transport a weight of 200 pounds through soft snow without resorting to the plan of dividing the weights. If the whole journey were performed over soft snow we should perhaps adopt the Hudson's Bay plan of flat sledges with light weights, but as the soft snow on the road is never continuous, and heavy pressed-up ice is the usual foe that we have to encounter, we must, like the Esquimaux, keep to runner sledges as being the most appropriate for general work.

In consequence of the very widely-spread belief that the Pole can be reached by other means than by sledging over the ice, perhaps I had better add a few words on the subject.

Arctic travelling must always be most severe work. I would, therefore, request our many friends who suggest plans for assisting us over the ice to first mature their propositions in a more temperate region. Without in any way detracting from the suggestions, I may state that no one can realise what Arctic sledge-travelling really means until he has travelled across country, totally on his own resources, say, from London to Edinburgh and back again. If the advocates for ballooning will start from the north of Scotland, carrying their own provisions, visit Iceland, 450 miles distant, and return exactly to their starting-point—for a mistake of 20 miles would be fatal—without receiving any outside aid, then only can we entertain the idea of using a balloon.

Time permits me to allude to the present migration of the Eskimo from the south-east part of Greenland towards the Danish settlements near Cape Farewell, where from 10 to 12 become incorporated yearly with the more civilised Eskimo, living happily and in comparative comfort under the well-ordered supervision of the Danish officials. Knowing that glaciers cut off these people from travelling south along the west coast of Greenland, we may conclude that they have crossed from Grinnell Land to Polaris Bay, journeyed round the north end of Greenland, and passed to the southward along the eastern shore to richer hunting-grounds, as

proved by the presence of numerous bears, which can scarcely exist in regions where Eskimo are unable to obtain sufficient food.

Before concluding, I should like to say a few words regarding the *Polaris* Expedition, for that ship most undoubtedly must have met the same kind of ice that we did. They must be credited with having reached the limit of navigation on the east side of Robeson Channel, as we did on the western side, and Captain Buddington was perfectly correct when he stated that they could go no farther. Had he not been overpowered by a majority, he would have informed us of the nature of the Polar ice some years ago. We all look upon Captain Buddington as a very hardly-used man. Had the travelling-parties from the *Polaris* been organised as Hall would doubtless have done—on the plan first organised by Sir Edward Parry—they would have told our story to the world instead of our doing so now. However, it must be remembered that where we had 120 disciplined men, the *Polaris* had only a crew of twenty-seven.

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## 2. *The Winter Quarters of the 'Discovery.'* By Captain H. F.

STEPHENSON, R.N., C.B.

ARCTIC service has always been and always will be most popular in the Royal Navy. There is so much of novelty and real interest in the far North, such a wide field of adventure for those who delight in penetrating the unknown regions. It has been said, Arctic service is the finest nursery for seamen in the world. This should not be accepted literally, for as far as actual seamanship goes, the ships are frozen-up for eleven months out of twelve. But I must say the leader of a sledge party requires all the perseverance, pluck, endurance, and resource that human nature is capable of possessing.

The *Discovery* went into winter quarters on the 26th of August last year, and the *Alert* on the 1st of September. Winter quarters means the selection of a well-sheltered bay or inlet in which the ship can be frozen-in close to the shore, and not subjected to the pressure of the moving pack; this is most essential.

The *Discovery* was very fortunate in finding a large, well-sheltered bay or fiord on the north side of Archer Sound and on the west coast of Robeson Channel. The fiord ran east and west (true) for 15 miles, varying in width from one to two miles, surrounded by hills 1300 feet high, making it one of the finest harbours I have ever visited in the world. At its entrance there was a large

island, called Bellot Island, standing 2000 feet above the level of the sea. On either side of this island was a good channel,  $1\frac{1}{2}$  mile wide, into Discovery Bay. These we termed the eastern and western entrances, and before being frozen-up, quantities of ice drifted in with the tide at one entrance and out at the other: but from this we found no inconvenience, a projecting point of land generally pushing the ice clear of the anchorage. The ship wintered in the north-east corner of this bay in 12 fathoms of water, within 200 yards of the shore.

The interior of the surrounding country was mountainous in the extreme, intersected in all directions by valleys and defiles. We found musk-oxen, hares, ptarmigan to abound, with two sorts of seal in the bay (the floe-rat and the large ground-seal). The harbour was tidal; highest rise of spring tides was 7 feet, and lowest neap was 4 inches; this caused the ice-foot round the bay to become from 15 to 20 feet thick, rugged in the extreme, and breaking away from the land, gave us a very indifferent landing-place.

On the night of the 5th of September, 10 days after our arrival, the ship was frozen-in, and remained in that position till the following 20th of July; making a total of  $10\frac{1}{2}$  months imbedded in the ice.

The first thing to be done in preparing the ship for winter quarters was to land six months' provisions, stores and fuel, in case of being burnt out, as that was our greatest danger; to place the various stoves in position, with clear instructions concerning the fires, and the amount of coal each was to consume during the 24 hours. To have all the pipes and pumps carefully drained of water; to get the winter-awnings up, and make the ship as snug as possible aloft; to have all well lighted between decks, so as to give a cheerful appearance to everything. These are matters of detail, but they add much to the comfort of all, as well as to each individually.

A layer of snow was placed on the upper deck from 10 to 12 inches thick, and as we found it would not bind, ashes and water were mixed with it, which soon became frozen hard, and gave us a good macadamised road to walk on. As soon as a sufficient quantity of snow could be collected, a wall of from 15 to 20 feet thick was piled up outside the ship to a level with the upper deck, for the purpose of keeping the heat in; this, and the snow on the upper deck, added much to the comfort inside, causing an equal temperature, which ranged between  $48^{\circ}$  and  $56^{\circ}$  on the *Discovery's* lower deck throughout the winter, though not diminishing the condensation,

which was considerable, producing a moist muggy atmosphere, with a continued drip from the beams on the lower deck.

On the 16th of October, 1875, we lost sight of the sun for 135 days; up to that date shooting, exploring, and surveying parties had been organised in the neighbourhood of the ship; but the strong currents down Robeson Channel and Lady Franklin Sound kept the ice in motion outside the harbour, which gave us little or no opportunity of sledging during the autumn.

The game killed about Discovery Bay up to that date was 32 musk-oxen, 23 hares, 8 ptarmigan, 6 seals, and 5 eider-duck; giving us a liberal supply of fresh-meat throughout the winter, and when the darkness came on we had no less than 3053 lbs. of frozen fresh-meat hanging up outside the ship. I cannot say musk-ox is very palatable, as it was exceedingly musky in flavour, though we found it a change from the preserved meat; 800 lbs. per month was what we usually consumed,—that was at the allowance of  $1\frac{1}{2}$  lb. per man every third day.

Since our arrival in England I have been offered 50*l.* for the head of one of these beasts; and people appear astonished so few skulls and skins have been brought home; but as these animals were killed at some distance from the ship, conveying the meat only on board, over so difficult a country, was a work of great toil and trouble, and tried the enduring powers of all.

During this period Lieut. Archer undertook the survey of Discovery Harbour, and many were the difficulties and amusing scenes I have witnessed that officer overcome, particularly during the time the bay-ice was forming. On one occasion, when some distance from the ship in the dingy, the ice became thick so rapidly that it was with the greatest difficulty he, assisted by another hand, could pull the boat through it, those on board the ship being unable to render any assistance; and it was not till after many hours of toil that he succeeded in reaching land, leaving the dingy behind him until the ice was strong enough for it to be brought over. When the ice could bear the dog-sledge, many were the duckings the same officer underwent in the pursuit of his favourite branch of science.

During the winter, Captain Beaumont, in addition to his duties as senior executive, was busy with the pendulum instrument. But the clock never going for 24 hours consecutively, owing to the intense cold that we experienced, he was not successful in obtaining any observations, though I can bear witness to the untiring perseverance he displayed, and his own disappointment at the want of success in that department. He and Lieut. Archer took astrono-

mical observations during the winter; the difficulties of which are very great in those regions—mercury freezing, the quicksilver on the reflecting-glasses of the sextant cracking and becoming useless; then the impossibility at times of reading the observation off, owing to the heat of the eye dimming the magnifying-glass, and the breath freezing on the arc of the instrument;—these, and several other impediments, call forth an amount of zeal and ingenuity that can only be understood by those who have attempted it.

Lieuts. Archer and Fulford had the magnetic observations to take. They erected their own wooden observatory on shore, as well as an ice-house on the floe for the differential declinometer magnetometer. Hourly readings of this instrument were taken between the 22nd of October, 1875, and the 30th of March, 1876.

Dr. Ninnis undertook the whole of the meteorological observations.

Dr. Coppinger the conduction of ice, ozone in the atmosphere, and carbolic acid between decks.

Mr. Conybeare observed all auroras and lunar phenomena. As they were without any defined lines or brilliancy, there was no opportunity of observing with the spectroscope.

The thickness of the ice formed in Discovery Bay was measured monthly. On the 1st of October, 1875, it was  $10\frac{1}{2}$  inches thick, and on the 1st of June, 1876, it was 38 inches; so that it increased regularly 4 inches a month between those dates.

The amount of snow that fell at our winter quarters up to the end of last year was 10 inches, and during the whole winter we only estimated it at 13 inches.

Rain fell on the 5th and 7th of July.

I have mentioned these details in full, as I have been so frequently asked, "What did you do in the winter, during those 135 days without the sun?" "Was not the darkness terrible?" And, in reply to these questions, I consider the winter by far the most agreeable time of the whole period spent in the Arctic regions. For 109 days out of the 135 we had the stars shining brightly at mid-day. The ship was very warm and comfortable. Our amusements were of the most enlivening description. The Royal Alexandra Theatre was opened on the 1st of December with a performance by the officers; men and officers throughout the winter took it in turns every fortnight to give an entertainment. Popular concerts and penny readings were held every Saturday night, some of the songs and poems being of the most original description, and, besides, all were employed in work most interesting

to themselves; some of them with more work than they could accomplish. Each one carried on his chain of observations through the winter, until the sledging season began, when men and officers were broken up into parties and separated for four months. The account of the hardships and difficulties of the sledge-crews must be read separately to be appreciated.

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3.—*On Sledge Travelling.* By Captain A. H. MARKHAM, R.N.

HAVING been deputed by Captain Nares to address you this evening on the subject of sledge travelling, it would, I think, be advisable to preface my observations with a few remarks regarding the method of exploring by this means.

The travelling season in the Arctic regions is necessarily very limited. In the autumn it can only be commenced after the ship has been safely established in winter quarters, and can therefore, at that season, never be of long duration, the departure of the sun compelling the travelling parties to return in about three or four weeks.

Parties are despatched at this late season of the year in order to reconnoitre the coast-line, and to advance depôts of provisions, in readiness for the main exploring parties that will leave the ship in the following spring. In the spring it is injudicious to send the exploring sledge parties away until the temperature has made a decided rise; and it is also imperative that they should return before the thaw has thoroughly set in, and before a disruption of the ice has occurred—a period, in the latitude in which we were situated, of about seventy or eighty days.

The sledges that were ordinarily used, and to which we gave a decided preference, were what are commonly called the eight-man sledges, each crew consisting of an officer and seven men. The extreme weight on these sledges, when packed and fully equipped, for an extended journey, was, on leaving the ship, 1700 lbs., or at the rate of from 220 to 240 lbs. per man to drag. The tents—each sledge crew being provided with one—were 11 feet in length, affording space for each man a little under 14 inches to sleep in; the breadth of a tent being about the length of a man.

Our costume was composed of duffle, a woollen material resembling thick blanket, over which was worn a suit of duck, to act as a “snow repeller.” Our feet were encased in blanket wrappers, thick woollen hose, and moccasins. Snow-spectacles were invariably worn; after the first adoption we were comparatively

exempt from snow blindness. We slept in duffle sleeping-bags, and our tent-ropes were made of the same material.

We had three meals a day. Breakfast during the intensely cold weather was always discussed in our bags. It consisted of a pannikin full of cocoa and the same amount of pemmican with biscuit.\* After marching for about five or six hours, a halt was called for luncheon. This meal consisted of a pannikin of warm tea, with four ounces of bacon and a little biscuit to each man. When the weather was intensely cold, or there was any wind, this meal was a very trying one. We were frequently compelled to wait as long as an hour and a half before the tea was ready, during which time we had to keep continually on the move to avoid frost-bite. The question "Does it boil?" was constantly heard, and the refractory behaviour of the kettle tried the unfortunate cook's temper and patience to the utmost.

After the day's march, usually from ten to eleven, and sometimes twelve, working hours, had terminated and every one was comfortably settled in their bags, supper, consisting of tea and pemmican, was served, after which pipes were lighted and the daily allowance of spirits issued to those who were not total abstainers. The mid-day tea we found most refreshing and invigorating, and it was infinitely preferred by the men to the old custom of serving half the allowance of grog at that time.

In September, 1875, the ship having been established in winter quarters, and a preliminary sledging party having returned to the *Alert*, after an absence of four days, one on a more extended scale left the ship, consisting of three sledges, with three officers and twenty-one men, a couple of dog-sledges having started a day or two previously to act as pioneers. The temperature on leaving the ship was at zero, but fell, during our absence, as low as 25° below zero. A sudden fall one day was most disastrous, causing several severe frost-bites, resulting, in a few cases, in amputation. These frost-bites were due to our foot-gear being in a constant state of saturation, caused by the frequent immersions that the whole party were subjected to, in consequence of the rotten and weak state of the ice. A heavy fall of snow, which fell for twelve consecutive days, made the work very laborious; whilst the newly-formed ice and lanes of water between the floes rendered all travelling over the pack out of the question, obliging us to adhere to the coast-line. So deep was the snow, that on several occasions we were obliged, with the aid of our shovels, to clear a road; and

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\* The pemmican was always mixed with a proportion of preserved potatoes.



then by the united efforts of the three sledge-crews, to drag each sledge separately, until the difficulty was passed. These snow-drifts occurred more frequently off the extremes of capes and headlands, and at the mouths of ravines. The excessive labour was due, not so much to the sinking of the sledge-runners into the deep soft snow, as to the arduous nature of the travelling, caused by the men themselves sinking into this soft substance, and only with great difficulty dragging their legs out again.

During this journey of twenty days we marched a distance of over 200 statute miles. It was then we succeeded in planting the English flag a mile or two beyond Sir Edward Parry's highest position, and thus wrested from that distinguished Arctic explorer the honour he has held for the last forty-eight years. Our first-lieutenant, now Commander Pelham Aldrich, was the first to wrest this honour from our great and revered predecessor.

From this autumn travelling we derived much useful experience, which materially assisted us in our operations whilst organising and equipping the sledges for the spring campaign.

In spite of the very comprehensive and detailed instructions and hints received, before leaving England, from Sir Leopold McClintock, connected with sledge-travelling in general, we, in the *Alert*, profited to a very great extent by the knowledge and experience of Captain Nares, without which we should most decidedly have been subjected to a greater amount of discomfort and privation; but this was lessened by his judicious care and forethought.

I omitted to mention that, in one instance during the autumn sledging, being unable to round a point of land in consequence of its precipitous nature, we were obliged to cross a range of hills, which, on account of an extremely uncomfortable night spent on its summit, was subsequently designated Frost-bite Range; and to do so we had to unpack our sledges and carry everything piecemeal across, the sledges being eventually lowered down a steep incline of from 250 to 300 feet in height.

The equipments for the spring campaign kept us fully occupied during the winter.

On the 3rd of April we had the satisfaction of seeing seven sledges drawn up in line, packed and provided for an extended absence; and a band of fifty-five officers and men, apparently in the very best health, ready and willing to drag those sledges as long and as far as their strength would admit.

It was a brave sight on that fine, though cold, morning to witness the gallant array of sledges, each flying their several distinguishing

standards, worked by the fair hands of some loved and cherished one at home, and to observe the enthusiastic eagerness depicted on each individual's face, all animated with the same zealous desire to do their utmost for the credit of their profession and the honour of their flag, in the achievement of all that was practicable.

The programme was to the following effect:—The sledges were to travel together, mutually assisting each other when required, until arrival at the dépôt established during the autumn in the vicinity of Cape Joseph Henry, about 40 miles north-west from the ship. There the two extended parties (the northern and the western) would branch off towards their respective destinations, the auxiliary or supporting sledges returning to the ship immediately their part of the work was accomplished.

The northern division consisted of a force of two officers and fifteen men, equivalent to a couple of sledge-crews. Their instructions were to proceed over the ice with the object of reaching as high a latitude as possible. As the disruption of the pack before their return to land had to be taken into consideration, they were provided with two boats capable of containing the entire party. These boats, although not sufficiently large for navigable purposes, would answer admirably as a means of ferrying from one floe to another. They were dragged on two of the sledges. As it was impossible to lay out dépôts of provisions for this party, with any certainty of their being found, they were compelled to carry with them the whole amount of provisions for the anticipated number of days' absence. Consequently a third sledge had to be dragged. This would necessarily render the progress slow and tedious.

The western division consisted of an officer and seven men, dragging one sledge. They were accompanied by a supporting sledge for a week or ten days, after separating from the northern division. It was their duty to explore along the coast-line to the westward.

Another extended sledge-party, one belonging to the *Discovery*, was exploring to the eastward along a portion of the northern coast of Greenland, whilst other parties from both ships were engaged in other important investigations.

When we started the temperature was as low as  $-33^{\circ}$ , falling in a couple of days to  $-45^{\circ}$ , or  $77^{\circ}$  below freezing-point. The cold then was so intense as to deprive the majority of the party of sleep, in spite of the weariness induced by a hard and toilsome day's work. Comfort, with our sleeping-bags and tent-ropes frozen so hard as to resemble sheet-iron more than woollen substances, was quite out of the question. The very appearance of our coverlet, when passed into the tent, was sufficient to banish all ideas of comfort or sleep.

So hard was it frozen that it was with the greatest difficulty unfolded, and not all the beating with which it was assailed would reduce it to anything like shape. When it eventually thawed from the heat of our bodies, it became a "wet blanket" indeed. The lowest temperature recorded *inside* the tent was one night shortly after supper, when the thermometer was as low as  $-25^{\circ}$ .

No temperature *above* zero was registered until the 28th of April, and it never rose to the freezing-point until June.

The operation of putting on our duffle-jumpers after camping for the night, although a severe one, afforded us much merriment, such strenuous exertions having to be made to struggle into them; so stiff and hard had they become from the intense cold, they resembled "strait jackets" more than articles of ordinary apparel. For the first three or four weeks after leaving the ship our bacon was frozen so hard as to be almost uneatable; after a time, however, we made it palatable, by soaking it in our warm tea until thoroughly thawed. This, of course, had the same effect on the tea as if pieces of ice were put in, cooling it rapidly, which was a disadvantage; but then it had the effect of converting that beverage into a decoction resembling soup, which, perhaps, on the whole, was more strengthening, however disagreeable it might be in flavour. As a rule, we were assailed by an intolerable thirst, which we were unable to assuage for two reasons: first, that we could not afford sufficient fuel to condense extra water; and secondly, it was quite impossible to prevent the water in the bottles from being converted into ice, in spite of the tin water-bottles being kept inside the waistband of the trousers.

I will now describe the advance of the northern party.

It became only too evident, even before we bade farewell to the supporting sledges, that our hopes of attaining a very high latitude would not be realised.

The ponderous nature of the ice over which we had to travel, and the heavy weights we were compelled to drag on our sledges, rendered progress slow and tedious. Added to which the terrible malady that gradually, but surely, attacked and prostrated the men, augmented the difficulties that we were called upon to encounter.

Large floes with smooth flat surfaces, were rarely met; in fact, floes of any size affording good travelling were few and far between. In place thereof we had small but heavy floes, presenting an uneven surface, and surrounded by broad belts of stupendous hummocks, varying from 15 to 50 feet in height, and from 20 yards to a quarter and half a mile in breadth. Around

these hummocks were deep snow-drifts, through which we frequently floundered up to our waists, the snow on the actual floes being as much as from 2 to 3 feet deep. Numerous cracks and fissures were treacherously concealed by the snow, and only discovered by some one of the party falling through and almost disappearing. Our method of travelling was to advance a party of five or six men provided with pickaxes and shovels, for the purpose of cutting a road through these fringes of hummocks; or on occasions when they were so massive and heavy as to render such a proceeding impracticable, we were reduced to the necessity of making a road *over* them. Then the sledges would be dragged up separately by the remainder of the party to the commencement of the road, when "all hands" would unite in dragging them up the steep incline, lowering them down on the opposite side. Occasionally the sledges would have to be unpacked or lightened considerably before, with all our concentrated strength, we could haul them over the hummocks or through the deep snow-drifts.

Sometimes surrounding the floes and between the hummocks existed streams and patches of young ice—ice of one season's formation—evidence of an annual disruption of the pack. Where these were of any extent, and trended in the right direction, they afforded good travelling, but we rarely benefited by them for more than a few yards. The hummocks were of two descriptions, namely, fragments of ice broken off by the pressure of two floes coming into contact, and piled up in small masses to the height of 40 and 50 feet; and the large isolated floebergs, similar to those that afforded such protection to the *Alert* in her winter quarters, that were occasionally passed during our march. Some of these were apparently situated in the centre of the floes, and some along the edges. I say apparently, because in one or two instances these huge bergs were observed standing out in solitary grandeur in the centre of a plain sea of ice, but, on account of the depth and smoothness of the snow at its base, it was impossible to determine whether its position was at the extreme of a floe that had come into quiet contact with its neighbour, or whether its situation was, as it appeared, in the very centre of one.

As we advanced in a northerly direction, instead of—as we all so ardently hoped and anticipated—the floes getting larger and more level, we encountered heavier hummocks and deeper snow-drifts, until, at our extreme point, we arrived at a perfect labyrinth of squeezed-up hummocks, through which with sledges it would be most difficult and tedious to make any progress. The journey home was a repetition of the outward one, with the exception of

the task of road-making; for we succeeded, although not without great difficulty, in adhering to the road already constructed, until within about three or four days from the land, when, owing to a blinding snow-drift, rendering it impossible to see ahead, we wandered off, and were not able to pick it up again.

The terrible sickness with which the sledge parties were afflicted materially increased the difficulties. The duties of the sick necessarily devolved upon others. Thus those brave fellows who, although suffering from this painful and wasting disease, resolutely persevered at their work, had, in addition to their own duties, that of tending and nursing the sick, who were so completely helpless and prostrate as to be unable in any way to assist themselves.

Although the distance from the ship reached by the northern division was, comparatively, small, so often had the road to be traversed that the actual distance marched by that party was 600 statute miles.

The western division, to which we will now turn, was eminently successful, in spite of the insidious malady with which they also were assailed, having explored 220 miles of new coast-line, during their eighty-four days' absence from the ship.

The heavy hummocks and floebergs, that offered such a serious impediment to the advance of the northern division, were piled in large masses against Cape Joseph Henry. Thence they ran in a line nearly parallel to the shore, at a distance varying from 2 to 4 miles.

To avoid these obstacles, the land was crossed to the south of the Cape by a long valley, covered with deep soft snow, 15 miles in length. Thence emerging on the ice, the same soft snow was encountered, rendering the progress slow and compelling them to drag their sledges on singly, during the time the supporting sledge was in company, after which they were obliged to resort to a method of advancing by half loads only. This necessitated the journey being made three times over the same ground.

Cape Columbia, the most northern known land, was rounded on the 1st of May, and from this point the prospects of the explorers brightened. The deep soft snow through which they had been struggling came to an end, being replaced by snow of a harder consistency, that afforded comparatively good travelling. From this most northern point of land the coast trends to the westward for about 25 miles, and then gradually to the southward of west. The extreme point reached on the 18th of May, forty-five days after their departure from the ship, was to the southward of the *Alert's* winter quarters and within 30 geographical miles of the limit of

exploration in the ship, as laid down in the instructions from the Admiralty for the Expedition. During the journey, they crossed several low projections that appeared to act as cushions, or fenders, in keeping off the line of hummocks. These were formed off nearly every prominent point, and in some cases extended along the coast-line for a few miles. The return journey was not performed more rapidly, although the load on the sledge was considerably lightened, than the outward one, in consequence of the decreasing strength of the party, and also by reason of the soft sludgy state of the snow, produced, towards the completion of their journey, by the increasing power of the sun. The entire distance travelled by this division was 725 statute miles.

The other extended party, belonging to H.M.S. *Discovery*, was ordered to explore the coast of Greenland towards the north and eastward, making the *Alert* their final starting-point, leaving her on the 20th of April and crossing Robeson Channel to Repulse Harbour.

The travelling experienced by this party was very arduous. Like their comrades engaged on the northern line of exploration, a road had to be constructed whenever they ventured on the pack at any distance from the land, and the same system of double-banking had to be resorted to, as long as their auxiliary sledge was with them.

Whilst adhering to the coast-line, great difficulties were experienced in rounding the numerous points of land; so deeply covered were they with snow-drift, that they rose to the same altitude as the large floebergs which were pressed on shore in their immediate vicinity.

Between these points of land, or snow-slopes as they were more generally called, and the grounded hummocks, were deep and precipitous gaps formed by the eddying wind.

The only way by which these slopes could be passed was by partly unloading the sledges, and then dragging them over separately by "all hands." They were so steep and slippery that it was impossible for the men to maintain their footing on them. The angle of inclination, carefully taken by means of a clinometer, varied from  $20^{\circ}$  to  $24^{\circ}$ , the slope terminating in an almost perpendicular drop. To surmount this difficulty, it was necessary to cut a road in the hard snow wide enough for the whole breadth of the sledge.

This mode of progression was excessively trying to all, bringing an unusual strain on their ankles, causing them to swell and become stiff; it also tried to the fullest extent the durability of the sledge-runners.

The extreme point reached by this party was in lat.  $82^{\circ} 18'$ ; the most distant land, Cape Britannia, apparently an island, with very high land behind it, being placed by estimation in lat.  $82^{\circ} 54'$ .

At this, their highest position, the large floebergs and hummocks stretched away to the westward for some miles, then, turning to the northward, ran straight for the west end of the distant land, forming a distinct line of demarcation.

To the eastward of this boundary the ice was smooth and level, whilst to the north and west lay the chaotic and impenetrable Polar pack.

It was with great reluctance that the explorers turned their faces homewards from an expedition so full of interest, but their gradually failing strength and diminishing provisions were warnings too decided to remain unheeded.

After a toilsome journey, the depôt established at Polaris Bay was reached on the 30th of June, 71 days after leaving the *Alert* and 85 days from the date of departure from their own ship, the *Discovery*. Here, with the aid of seal-meat and musk-ox flesh, the health of the invalids was somewhat recruited; and after a forced and prolonged stay, a start was again made on the 8th of August for the purpose of crossing Kennedy Channel with the object of returning to their ship. This was not easily accomplished. The ice, at this season, was in motion; it therefore became absolutely necessary to carry a boat. The passage across was most hazardous, and they only succeeded, by working for 22 and 35 consecutive hours without rest, in reaching their ship in safety on the 15th of August.

On two or three occasions they had the extreme mortification of finding that, during the night, they had drifted so rapidly to the southward and eastward, as not only to lose entirely what they had so hardly earned, but to be actually further from their goal than they were before starting the previous day.

The return of this party brought to a conclusion the sledging operations of the Expedition.

The several sledge-parties engaged in these duties, both in the autumn and the following spring, experienced the same continuous heavy fall of snow. This not only retarded their progress by making the travelling heavy and more laborious, but also augmented the difficulties by rendering the air so impervious as to make the task of selecting a route both perplexing and wearisome.

The snow over and through which the sledges had to be dragged was generally over the men's knees, and frequently up to their waists. It was of such a consistency, the upper layer or crust

being slightly frozen, that they were unable to force their legs through it, and were therefore compelled to lift them straight out of the holes before they could be either advanced or extricated. This was very exhausting; walking for an hour through this description of snow being infinitely more tiring than dragging a heavy sledge for the whole day.

On several occasions the men found it not only easier, but they could make better progress whilst dragging the sledges, by crawling on their hands and knees, than by dragging in the more orthodox manner, on their feet.

In conclusion, I would desire, not only in my own name, but in the name of all those officers who commanded the several sledge-parties during the recent Expedition, to pay my tribute of praise to our gallant companions who bore the principal brunt of hard work whilst employed in their interesting work of exploration. Those brave fellows, though suffering acute bodily pain and almost unheard-of hardships and privations, bore their sufferings with manly fortitude and endurance, without a murmur or complaint; animated by the same praiseworthy zeal and devotion to achieve all that was possible for the credit of their profession and the honour of their flag.

HIS ROYAL HIGHNESS the PRINCE OF WALES rose and said :

Ladies and Gentlemen,—After the admirable addresses that we have heard on the part of the President, and the able and most interesting papers which have been read by Captain Sir George Nares, Captain Stephenson, and Captain Markham, it would be perfectly superfluous on an occasion like the present for me to make any remarks; but it affords me the greatest pleasure and the highest satisfaction to be allowed to move a vote of thanks to these gallant officers for the interesting and pleasant evening they have afforded us, and also to ask you, ladies and gentlemen all, most enthusiastically and most cordially to give them that hearty and British welcome which they have so thoroughly deserved.

Sir HENRY RAWLINSON then spoke :—

Your Royal Highness, Sir Rutherford Alcock, Ladies and Gentlemen,—As I had the good fortune to represent the Royal Geographical Society in those preliminary discussions two years ago which led to the despatch of the Arctic Expedition, I am naturally much pleased at being allowed on this occasion to second the vote of thanks which has been proposed by His Royal Highness the Prince of Wales, to be given to the officers of the Arctic Expedition by the Royal Geographical Society on their return from their perilous voyage. Ample justice has been done, but not more than was thoroughly deserved, to the public services of Sir George



Nares and his companions, both by our excellent President in his eloquent opening address, and also by the remarks of His Royal Highness, whose solicitude is well known for the national interests and the national honour. He is never more at home than when he is bestowing well-merited praise on British officers who have done their duty. But, ladies and gentlemen, I venture to suggest that while full justice has been done to the public and professional services of Sir George Nares and his companions, sufficient attention, perhaps, has hardly been drawn to the scientific services of those officers, which nevertheless are what principally concern this Geographical Society as a practical scientific body. It will be remembered that when the Geographical Society, in concert with the Royal Society and other leading scientific bodies, recommended the despatch of an Arctic Expedition, the scientific advantages of such a measure were especially dwelt upon. It was urged, and it was urged with truth, that the despatch of an Arctic exploring expedition to a high northern latitude was a necessary complement to the voyage of the *Challenger*; and it was mainly in deference to this view that the Government acceded to the prayer, and summoned Sir George Nares from the command of the *Challenger*, at one extremity of the globe, to the command of a sister expedition at the other. And what has been the result? Although the unreachable Pole has not been reached, still the expectations of Government and of all the friends of the Society have, I venture to say, not been disappointed. Those who have listened this evening to Sir George Nares' ingenious arguments, and have reflected upon the vast amount of observation, of thought, and of inquiry, which was necessary for the elaboration of those arguments, must feel inclined to place him in the first rank of Physical Geographers. The scientific materials, indeed, which he has accumulated in the command of these two expeditions, his multitudinous observations, and his extensive research, have not only added greatly to his personal reputation, but have reassured for England that leading place which she formerly occupied among the scientific maritime nations of the world. And, ladies and gentlemen, I will venture on one word further before I sit down. I would remind you that, greatly as we must admire the public and professional services of Sir George Nares and his officers, greatly as we value those services, and we do greatly value them, still his scientific additions to our acquaintance with the laws and operations of Nature in regions hitherto very little known, are, after all, the most lasting and the most important portion of his labours; not ministering to the glory of a single profession or a single nation, but adding to the great sum of human knowledge, and thus contributing to the happiness and welfare of all mankind. In grateful admiration, then, of the public, the professional, and the scientific services of Sir George Nares and his companions, I venture to recommend most heartily to the approval by the Fellows of the vote of thanks and congratulation which has been moved by His Royal Highness the Prince of Wales.

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*Fourth Meeting, 8th January, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Edwin H. Newby, Esq.*

ELECTIONS.—*Emil Brass, Esq.; Henry Rowland Brown, Esq.; T. H. Crane, Esq.; J. Gerson da Cunha, Esq., M.D.; Israel Davis, Esq., M.A.; Rear-Admiral the Right Hon. Lord Gilford; William C. Harvey, Esq.;*

*William George Horncastle, Esq.*; *W. G. Francis Hunt, Esq.*; *George Inverarity, Esq.*; *Sir John H. Kennaway, Bart., M.P.*; *Frederick George Lewin, Esq.*; *Francis H. Lyell, Esq.*; *Capt. H. C. Marsh*; *Joseph Sylvester O'Halloran, Esq.*; *Thomas Parkin, Esq., M.A.*; *Charles B. Renshaw, Esq.*; *Edward C. Rogers, Esq.*; *George Thorpe, Esq.*

DONATIONS TO THE LIBRARY, FROM 11TH DECEMBER, 1876, TO 8TH JANUARY, 1877.—*Geographie und Erforschung der Polar Regionen*, Nos. 123–125, von A. Petermann; Gotha, 1876 (*Author*). Are we drying up? By J. D. Whitney; Cambridge, U.S.A., 1876 (*Author*). Die Gruppierung der Confessionen in Bosnien und der Hertzegowina, von H. Kiepert; Braunschweig, 1876 (*Author*). The Emigrant and Sportsman in Canada, by J. J. Rowan, 1876 (*Author*). On the secular change of Magnetic Declination in the United States, by C. A. Schott; Washington, 1874 (*Author*). Bericht über Anlage des Herbariums während der Reisen, von H. von Schlagintweit-Sakünlünski; München, 1876 (*Author, per A. Grote, Esq.*). Imperial Government Railways, Japan. Report on routes from Tokio to Kioto and across to Nügata, and Report of lines laid out from Kioto to Tsuruga, &c., by R. Vicars Boyle; Kobé, 1876 (*Author*). *Eléments de Grammaire Franco-Serbe*, par C. Hecquard; Belgrade, 1875 (*Author*). The Imperial Museum for India and the Colonies, by J. Forbes Watson, 1876 (*Author*). Address delivered at the Glasgow Meeting of the British Association for the Advancement of Science, by T. Andrews, 1876 (*Dr. Andrews*). Die englische Nordpolexpedition 1875–1876, unter Capitan Nares, und ihre Resultate, von J. Chavanne; Wien, 1877 (*Author*). Victoria. Abstracts of specifications of Patents, 1854–1866, Metals, pt. 2, sect. 1, by R. Gibbs; Melbourne, 1876 (*Author, Registrar-General of Victoria*). Australian Statistics for 1875, and Statistical Register of Victoria for 1875, pt. vi. (*H. H. Hayter, Esq., Government Statist*); and the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM 13TH DECEMBER, 1876, TO 8TH JANUARY, 1877.—13 sheets of Admiralty Charts (*Hydrographic Office, through Captain F. J. Evans, R.N.*). Turkestan and the Countries between the British and Russian dominions in Asia; by Colonel J. T. Walker, R.E., F.R.S., &c. Third edition. 4 sheets (*India Office, through Major-General Sir H. Rawlinson, K.C.B., &c.*). Central Africa, by Dr. Josef Chavanne; Vienna, 1867 (*Author*).

After the Minutes of the previous evening meeting (December 12th) had been read by the Secretary (Mr. R. H. Major),

Sir MORDAUNT WELLS rose and made some remarks regarding the arrange-

ments made at the last meeting in St. James's Hall. On an occasion like that it was a strange thing that the comfort and convenience of the Fellows should have been ignored altogether. The Royal Geographical Society should have been above the ordinary system of granting patronage-tickets to the number, as he had learnt, of 500. Surely it was only becoming on the part of the officials to consider the comfort and convenience of the Fellows, who had supported the Council in their endeavours to persuade the Government to fit out the Arctic Expedition, particularly when it was remembered that amongst the Fellows there were men of advanced age, who had been treated in a manner unparalleled in the history of the Society, while ladies of position were crushed, and obliged to leave after their carriages had gone away.

The PRESIDENT said he was very unwilling to prevent any casual observation upon the Minutes, but, as no notice had been given of the question which Sir Mordaunt Wells had raised, no discussion could be permitted, except as to the accuracy or inaccuracy of the Minutes.

SIR MORDAUNT WELLS maintained that he was speaking with reference to the inaccuracy of the Minutes. The Minutes purported to be those of a Meeting of the Fellows of the Society, but substantially the last meeting was not a meeting of the Fellows of the Royal Geographical Society, and therefore the Minute was inaccurate in asserting that it was.

The PRESIDENT said he must rule that Sir Mordaunt Wells was not in order. The assertion that had been made with regard to the last meeting could not be justified, and distinct notice was given that as there were 6000 persons entitled to admission, it was physically impossible to accommodate one-half of them. This was not the occasion on which to discuss how far the Council exercised the powers given to them by the Charter, wisely or unwisely.

SIR MORDAUNT WELLS wished further to remark that, in consequence of the manner in which that meeting was held, it was quite impossible for any member of the Society to enter upon a discussion on the subject of the Arctic Expedition.

The PRESIDENT said that, again, was not a subject for consideration upon this occasion.

SIR MORDAUNT WELLS said that if the President ruled that he could not speak to the Minutes in that respect, of course he must bow to such a decision; but he begged most respectfully, on the part of many of the Fellows not present, to protest against the system that was adopted at the last meeting.

The PRESIDENT said the paper to be read was one of very considerable interest. It related to some Russian Expeditions of a semi-scientific character, accompanied by flying columns of troops, into Central Asia, on the borders of Turkistan by the Alai Mountains and the Pamir, and it raised a geographical question which went back as far as the days of Ptolemy. The paper consisted chiefly of a translation of the accounts rendered by the officers in command.

The following Paper was read:—

*The Russian Expedition to the Alai and Pamir in 1876.*

By ROBERT MICHELL.

[ABSTRACT.]

CAPTAIN KOSTENKO'S ACCOUNT.\*

THE scientific members of the expedition left Gulsha on the 31st of July (N.S.), overtaking the military force at Kizyl-Kurgan.

From Kizyl-Kurgan the road continued to zigzag, for the most

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\* From the 'Russian Invalid,' Nos. 206, 211, 229, 235, 239, 244, 250, October and November, 1876.

part, along high mountain-ledges. The frail, trembling bridges, suspended over the chasms, occasioned no small trepidation, although the men and horses passed in single file, and at a respectful distance one from the other. For an extent of about five miles, the men had to scramble over rocks and mountain sides, losing, however, only one pack-horse, which tumbled down a precipice.

The route lay up the valley of the Gulsha River.

At Sofi-Kurgan, a former Kokand fort, the road diverges to the Terek Davan (pass): the mountains forming the Gulsha defile lose in height from Sofi-Kurgan.

Towards the end of the second march the detachment emerged from the Gulsha defile, and crossed a small mountain range of soft clay (Kizyl-Kurt), halting for the night at the foot of it, by the margin of the bed of the Gulsha. The camp was pitched in a picturesque spot, after a march of nearly 19 miles.

On the 10th of August, the force struck camp at the Kizyl-Kurt, and proceeded to the Archat defile.

The first five miles of road from the Kizyl-Kurt were easy, after which came the pass over the Archat Mountains. This range is exceedingly steep, the crest of the pass is only one mile from the base, and 1500 feet above it. According to barometrical measurement, the absolute height of the pass is 10,300 feet. The peaks on either side, by measurement with the sextant, attain 13,000 feet.

The Taldyk Pass, further west, is considerably less steep, and may, therefore, more easily be adapted for wheeled carriages.

A magnificent panorama opens to the view from the top of the pass. In the foreground is the Alai Plateau, beyond it rises the Trans-Alai mountain range, screening from sight the least-known portion of the Pamir.

The valley, or rather the high table-land of the Kizyl-Su River, which lay at the bottom of the pass, is skirted on the south by a grand mountain chain, snow-capped throughout its entire extent. Almost directly opposite the Pass rises the peak which Mr. Fedchenko called Kaufmann Peak, in honour of the Governor-General of Turkistan.

The descent from the *Archat Pass*\* to the Kizyl-Su Valley, is only 6 miles long. A rivulet runs parallel with the defile, through which lies the descent, and the slopes on both sides are completely bare, while the hollow and the river, and the bottom of the valley

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\* Probably the same as that named *Shart* on our maps.—R. M.

are fringed and carpeted with a tall, thick and succulent grass variegated with flowers.

Crossing some narrow dry troughs, the detachment came to a halt for the night, at a distance of about 2 miles from the Kizyl-Su, by the side of a small river called the Kitchkene-Kizyl-Su, equally red in colour. The elevation of the ground here is 9300 feet.

On the 11th of August, the detachment marched in a southeasterly direction, to the base of the Trans-Alai Range.

The breadth of the Alai Plain in the section thus traversed is  $11\frac{1}{3}$  miles.

The halt was in the sub-alpine zone, on the north side of the Trans-Alai Mountains.

From this position the troops marched 18 miles, to the summit of the pass. There is a small lake beyond the range, called Kizyl-Kul,\* which is probably the source of the Kizyl-Daria, an affluent of the Kashgar River.

After crossing a second range of inferior altitude, the Russian detachment came in sight of a large lake—the Kara-Kul—lying within 43 miles of the northern base of the Trans-Alai Mountains. The plateau is surrounded by high snowy mountains. The water of the lake was azure; an island was observable in the middle of it. The surface appeared to be slightly frozen. According to the guides, Kashgar was distant only a leisurely ride of 6 days.

Captain Kostenko, who was sent on a-head to join a detachment which had preceded the main column on its way to Kara-Kul Lake, describes the way up to the Great Kizyl-Yart Pass from the north side, as follows:—

“We marched out of camp at 9 p.m., when it was pitch-dark, proceeding slowly and carefully, and trusting principally to the instincts of the horses to pass safely over the broken ground, for, although the furrows were not deep, their margins were like those of fissures, and the ground was also riddled by marmots. A ride of not quite 5 miles over the Alai Plateau brought the troop to the Kizyl-Yart defile in the Trans-Alai Mountains, which is formed by a stream of the same name flowing in several channels through the southern portion of the defile in a smooth hollow, so thickly studded with boulders that the horses were obliged to tread with great circumspection. Turning to the left, up an affluent of the main stream, and proceeding up the second or upper portion of the defile, it was found that the obstruction caused by these

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\* Red Lake.

boulders was still greater. Fortunately, however, the moon rose before the troop filed into this rock-strewn gorge. The top of the Kizyl-Yart Pass is 17 miles from the mouth of the defile. The road may be easily made available for wheeled carriages, by removing the stones which block the bed of the river and cover the mountain-slopes and the pass itself. The defile is particularly wild and desolate near the pass, the summit of which is at an elevation of 11,700 feet.

“From the summit of the pass a view is obtained of the Pamir generally, and in particular of the Pamir *Hargashi*\* (of Hares), in the southern portion of which lies Kara-Kul Lake.

“A mass of bare mountains, mostly snow-capped, stretching in various directions, also open to the view, and these seem to be intersected by more or less wide valleys and gorges, as denuded of vegetation as the mountains. The descent from the pass is easy and convenient, and is only  $1\frac{1}{2}$  mile long, when it terminates in the wide bed of a mountain-stream, called Kurrun-Sai (dry-bed). Notwithstanding this appellation, a stream runs here in a direction from south to north. On the Pamir side the foot of the pass stands on an elevation of 11,000 feet. The long and wide bed of the Kurrun-Sai merges into the very long Zak Valley, which extends from east to west.

“This valley has a width of about  $1\frac{1}{2}$  mile. Throughout its entire extent it is covered with boulders or with sand. The series of mountains enclosing the valley do not reach the height of perpetual snow; they are bare and rocky, composed of argillaceous sandstone, and wholly covered with detritus. At right angles with this valley the mountains are broken by transverse valleys. Through the breaks in these mountains (12,000 to 13,000 feet high) snow-capped mountains are visible to right and left. The valley extends 13 miles, gradually rising to the east and terminating in low ridges of conglomerate. Here an elevation is attained of 17,000 feet. From the summit of the pass over these mountains† the descent is into the hollow of the Kara-Kul Lake, and the eye takes in the wide basin of the lake, encircled by mountains.

“These latter mountains are mostly snow-capped, especially those to the east; and it is only on the west and north sides that a break in the snow-line is observable.

“The aspect of the hollow, with the large azure lake and its elevated islands, is very grand.”

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\* Abdul Medjid's Khurgashee.

† The range of inferior altitude previously alluded to.

After a gradual descent of 8 miles, the troop halted by the bank of a small stream flowing into Kara-Kul Lake, within  $1\frac{1}{2}$  mile of its mouth.

On the following day (15th of August) Captain Kostenko made an excursion to the island.

A considerable portion of Kara-Kul Lake is occupied by islands and by necks of land having the appearance of a high longitudinal ridge, intersecting the lake from north to south. The largest of the islands adjoins the north shore, being connected with it by a streak of land, like a bridge, about 250 fathoms long and 10 fathoms wide. This streak is considerably raised, being formed by a deposit of sand, brought by the prevailing north wind.

The island is  $5\frac{1}{3}$  miles long by  $2\frac{2}{3}$  miles broad, and consists of sand-hillocks, covered with fragments of mica-schist, like flattened skulls. Large masses of this schist project here and there from the tops of the hillocks, being set up almost vertically. The hillocks rise about 600 or 700 feet above the lake, so that both sides of the lake are visible from their tops.

A rude piercing wind blows daily from the north, beginning at 2 or 3 P.M. The hard sandstone exposed to this wind is strangely affected by it. Some of the rocks are perfectly drilled.

A magnificent scene opens to the view from the elevations on the island. The mountain circle seems to spring directly from out of the water, proudly looking at its own reflection in the glassy lake, whose blue waters lave the feet of the heights. In a direction due south, and in prolongation of the island, stretches a high sandy ridge, divided by a strait  $\frac{1}{3}$  mile wide by  $3\frac{1}{2}$  miles long. This ridge was apparently once an island, but is now a promontory.

The situation gives the idea of a gigantic crater, now filled with water. The snow-wreath of this crater was incomplete only at one point, but this hiatus was filled by a snow-capped range in the background.

Being separated by the above-mentioned ridge, the lake consists of two sheets of water—eastern and western, connected by means of the strait. The length of the lake is  $14\frac{2}{3}$  miles from north to south, and the breadth along a line drawn through the strait is  $11\frac{1}{3}$  miles from east to west.

The lake has not a single outlet, but, on the other hand, it receives several streams issuing from the mountains, all of which are fordable. The lake had evidently extended some way up the flats through which these rivers run, and in some places the margin of the lake is  $6\frac{2}{3}$  miles from the bases of the mountains, on the eastern side, while in some this is reduced to shorter distances.

On the western side the mountains rise from the water's edge, projecting in the shape of capes. Owing to this, one has to ascend and descend the spurs on the western side in order to pass round the lake. The approach to the lake is easy; the soil is sandy. The water is exceedingly cool and clear, even when agitated. To the taste it is somewhat bitter, so that, when thirsty, horses can very well drink it. There are fish in the lake, many little ones having been seen in the shallows. The great number of water-fowl skimming the surface also proves the presence of fish in the water.

The flat beach along the courses of the tributary streams is covered with a thin, but nourishing grass, which affords sufficient, if not abundant, food for beasts.

On the 18th of August, Captain Kostenko started on an exploring expedition to Lake Riag-Kul,\* "in the Sarikol district," towards the Kashgar boundary. The situation of the lake and of the district was roughly ascertained from a native, but the Russian party went on without a guide. Provisions were taken for three days, and the party rode out at 10 A.M., marching along the eastern margin of Lake Kara-Kul.

The road passed over a wide plain between the lake and the base of a snowy range which borders it. This plain was about 4 miles wide, narrowing at one point to  $1\frac{1}{2}$  mile.

After marching 16 miles and crossing several streams running into the Kara-Kul, the party put up for the night in a defile emitting one of these streams.

On the 19th of August, Captain Kostenko kept to the plain for about 3 miles further, and then turned into Ala-baital defile. The route lay up the head of the rivulet, which, in some places, ran underground. The defile, scattered with boulders, had a smooth ascent which grows steeper the further one advances. The summit of the pass is 4 miles from the entrance into the defile; the pass is 12,000 feet high. The mountain-sides of the defile, as well as the pass, are composed of soft substances covered in every part with fragments of schist.

A steep descent of  $3\frac{1}{2}$  miles brought the party down into the valley of the Chon-Su, at the point of its confluence with an affluent called the Uzbel-Su.

The valley of the Chon-Su † is about 2 miles wide, and it extends from south-east to north-west.

The valley of the Uzbel-Su, the right affluent of the Chon-Su, opens into the main valley at an obtuse angle within  $13\frac{1}{2}$  miles of

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\* Little Kara-Kul (?).

† Big River.



the outflow of the Chon-Su, so that the lower course of the latter is at the same time a continuation of the Uzbél-Su. Lower down the Chon-Su turns abruptly, and falls into the Kara-Kul at its southern extremity.

Having halted at the point of the confluence of these two rivers, Captain Kostenko followed up the course of the first named, going due east. This river has the character of all mountain-streams, and runs a course of 20 miles without any deviation from its general direction. In its lower course it is confined by mountains of an inferior height, which are composed of red clay and conglomerate, the road being obstructed by boulders and stones. The mountain-chains to right and left rise 2000 and 3000 feet above the valley; those, however, skirting the valley on the left or south side are somewhat more elevated, attaining a height of from 15,000 to 16,000 feet, and so rising above the snow-line.

The party advanced for the most part along a beaten path, which was taken to represent the high road from the Alai by Kara-Kul to Sarikol and to the Kashgar confines.

The mountain-ranges on either side of the Uzbél-Su Valley unite at the sources of that river, and so form the Uzbél Pass, separating the basin of the Kara-Kul from that of the Sarikol, and generally speaking from the rivers forming the Tarim-gol.

Two magnificent views are obtained from the summit of the Uzbél Pass, which is 12,500 feet above sea-level; one towards the west, with the entire valley of the Uzbél-Su clearly defined, and of the lower course of the Chon-Su, terminating with a snow-capped range of 16,000 to 18,000 feet in height, and closed as by a crenellated wall.

In front, towards the east, lies the valley of one of the sources of the Kashgar Daria. This high valley, like that of the Chon-Su, is skirted by mountains of no great height, those on the right or south side being again higher than those on the left, and in some parts capped with snow.

This valley, a long way ahead, seemed barred by a grand mountain-range, rising considerably above the snow-line. This is, doubtless, the range mentioned by Colonel Yule in his sketch of the geography and history of the sources of the Oxus,\* which forms the eastern boundary of the Pamir Plateau, separating the latter from Eastern Turkistan.

Referring to this range, Colonel Yule says that its peaks rise to an elevation of 20,000 to 21,000 feet. The distance from Uzbél

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\* Vide new edition of Wood's 'Oxus,'—Introduction.

Pass to this mountain-range is about 53 miles. Beyond it lies Kashgar, 40 miles further.

Captain Kostenko observes, that, as he has actually seen this great snowy range of mountains, one of the most important questions of the geography of Central Asia—that is, the question of Humboldt's meridional Bolor Range—may be considered as settled. He proceeds to say:—

“In recent times Russian travellers—first Severtsof and Fedchenko, and then Englishmen—denied the existence of this mountain-chain, arguing that the Thian-Shan and Himalaya systems combined to form the massy elevation which Humboldt took for a meridional range. It was the opinion of these explorers that the connection of the two gigantic mountain-systems was by means of a series of ranges mainly extending from east to west. Fedchenko, who visited the Ferganah Valley, the Alai Mountains and the Alai Plateau in 1871, came to the conclusion that the construction of the Pamir was similar to that of the tracts which he had seen, *i. e.*, that it was composed of longitudinal valleys skirted by mountains running parallel; and he positively denied the existence of meridional ranges. We have found,” says Captain Kostenko, “that the Pamir is very differently constructed; and having seen the meridional range with my own eyes from the top of Uzbek Pass, and made a discovery which is an important acquisition to geographical science, the range might very properly be called ‘Constantine,’ in honour of the august patron of geographical science in Russia.”

The distance from Uzbek Pass to the small Riangu-Kul Lake was held to be three “tash” = 16 miles, and from the latter to Sarikol,  $1\frac{1}{2}$  tash, or 8 miles.

The name *Sarikol*, meaning “yellow-hand,”\* is conferred on a locality including a valley and a river. The natives asserted that the valley was occupied by a considerable number of nomads.

The stream, pouring down eastwards from Uzbek Pass, falls in with another at the foot of the pass, forming a tolerably large river, which is said to flow through Riangu-Kul Lake, and to run thence into the Kashgar dominions, under the name of Sarikol. This, however, requires further confirmation.

The party returned to camp on the Kara-Kul on the 21st of August, by way of the little Chon-Su defile. This road was found much more convenient, and not at all longer than that over the Ala-baital Pass.

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\* Colonel Gordon interprets it “head of the mountain,” “Sir-i-Koh.”

On emerging from the defile the party turned to the right, leaving on their left the high road to Badakhshan. There are three roads diverging from the mouth of this defile, viz., one to Badakhshan, another to Kokand (over the Kizyl-Yart), and a third to Kashgar (over the Uzbél Pass). The Kara-Kul was reached at 3 P.M., and on the same day the whole of the detachment started back to the Alai to rejoin the main force, camping at Archab-bulak, at the southern base of the Alai Mountains, within about 13 miles of the mouth of the Kizyl-Yart defile.

A Russian cavalry troop, led by Prince Witgenstein, had preceded Captain Kostenko up the Chon-Su River, returning to Kara-Kul by way of the Tuyuk-Su Pass, over the snowy range. It was ascertained by the Prince, that the Aksu-Murghab flows 53 miles in a south-easterly direction, beyond that pass, after which the river emerges on a wide elevated plateau, known by the name of Ak-baital,† which means "White Mare." The extent of this plateau was said to be so great, that the mountain ranges which skirt it are not visible from the centre; and it is said to be traversed by a large and wide river called the Kara-daria, and by a road leading to Kashgar and to Afghanistan.

The following general observations are made by Captain Kostenko on that portion of the Pamir which he visited.

The Trans-Alai Mountains, having the appearance of an immense white-crested wall, limit the Pamir on the north. Beyond this range\* extends a high land gradually rising towards the centre. This high land is in all directions intersected by mountain ranges, some of which are snow-capped, others not; but generally speaking, having only a small elevation above the adjoining valleys and plain surfaces. The plains and valleys, or hollows, do not extend in any one particular direction, and in most cases they are not wide, say two miles. The valleys, as well as the mountain-slopes, are bare; they have neither trees, brushwood, nor grass. Small strips or patches of grass occur only along the courses of the mountain-streams; and this grass is in some places thick and succulent, affording food for the cattle of the nomads.

The mountains being of a soft formation, all the passes are comparatively low and easy. The streams, pouring down from no great altitudes, offer no impediment. Generally speaking, the roads on the Pamir are very easy in all parts; the ground is either sandy and stony, argillaceous, sandy salinous, or simply salinous. Where the salines have got dry, the ground is covered with a

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\* Mentioned in Abdul Medjid's Itinerary.

† Southwards.

thick layer of magnesium which glistens like snow. Occasionally one falls in with moist places, covered with a thick, but not tall grass, and wherever the ground is soft enough to retain impressions, one may observe the tracks of wild beasts.

There are neither bears, nor tigers, nor wild yaks on that portion of the Pamir which the Russians visited.

Returning from the Pamir to the Alai, that is, descending from an elevation of 11,000 or 12,000 feet to 8300 feet, the position at Archa-bulak, the Russians experienced great relief; they all felt as though they had lost a load from their shoulders; their breathing became more regular, and they felt generally in better spirits.

On the 28th of August, a portion of the Alai military column was moved from the position at Archa-bulak, to the late Kokand fort Daraût-Kurgan,\* along the Kizyl-Su River. This detachment marched all the way along the right bank of the river, skirting the base of the Alai range, which in no part attained the height of the snow-line, so that these mountains may be said to have an elevation of about 13,000 to 13,500 feet. The Trans-Alai Range, on the other hand, is snow-capped throughout its whole extent; but when the detachment passed, this range was enveloped in a dry mist, in reference to which Captain Kostenko observes that it is a common phenomenon in Kokand, and on the Pamir. He says that the mist is occasioned by a current of air in an upward direction, when an extremely fine dust is raised which subsequently carpets the whole neighbourhood.†

Daraût-Kurgan is situated on the right bank of the Kizyl-Su, at the mouth of the Isfaiam defile, through which runs the Daraût-Su. The detachment took up a position a little below the fort at an elevation of 7400 feet above sea-level.

On the 30th of August, a troop was sent up the Tuz-Altyn-Dara,‡ in order to reduce to obedience the Itchkilik Kirghiz, who evaded the Russian force on the Alai.

The road up this river follows its right bank, but there is a practicable way along the left bank also.

The head-water of this river is remarkable as giving rise to another stream flowing in a diametrically opposite direction. The

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\* Also occurring in Abdul Medjid's Itinerary.

† It was, perhaps, the prevalence of these mists that gave rise to the expression "Cimmerian darkness;" and Scythia was anciently called Cimmerian.—Rennell's *Herodotus*.

‡ The river is called "Tuz," after the quarries of rock-salt about 7 miles below the river-mouth.

Ters-Agar streamlet, falling from a snow-capped summit in the left or western range, divides into two at the base of the mountain, one flowing northwards, which forms the above-mentioned Tuz-Altyn-Dara, and the other running due south, preserving the name of Ters-Agar, and reaching the large Muk-Su River. In this way the defile and the source are common to both streams. The pass is almost imperceptible to the eye; its absolute height is 9700 feet above sea-level.

The troop camped on the pass, and resumed its march before day-break on the 31st of August.

Following the gentle decline of the defile 3 miles, the stream tumbles sheer into the deep and clearly-defined valley of the large Muk-Su River. The view of the Muk-Su Valley, and of the gigantic snowy range closing it in on the south, is the most beautiful and the grandest that can be imagined. The picture is changed as by the wand of a magician, and you suddenly behold a deep cavity, in the shape of a leviathan trough, with a smooth surface at bottom, covered with boulders, through which the Muk-Su rushes impetuously in innumerable branches. The trough lies between high, rocky, and precipitous mountains, those on the south being at that time covered with snow over two-thirds of their height. Several peaks project from this range, which the natives call Gou; some of them attaining a height of at least 25,000 feet. Two glaciers are suspended from the top of this mountain-range, reaching the valley below. Numerous milk-white streamlets purl down from under the glaciers. A third glacier clings to the side of a short range which borders the valley on the east.

The northern range has a height of from 14,000 to 15,000 feet, being covered with snow only in parts. It is less steep than the other, and a pathway has been formed over its crumbling side, by which Captain Kostenko descended into the valley of the Muk-Su. The northern confine of the valley from which the path begins to descend is 9500 feet above sea-level. This path zig-zags between large stones scattered over the detritus, and is thence miles long. Vegetation occurs here and there on the declivity, represented by the *Archa*\* and by a few very poor little birch-trees.

The bottom of the Muk-Su Valley is not wholly covered with boulders. At the bases of the northern range there are streaks of land overgrown with copses of willow, briar, and other thickets. These copses are irrigated either by springs, overflows of the Muk-Su, or by rills from the mountains, and are called "tuga."

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\* *Juniperis pseudo Sabinus.*

They stretch at intervals of about a quarter of a mile, and mainly afford the Kara-Kirghiz (Itchkiliks) that shelter and means of existence which they seek.

The Muk-Su is a large body of water, and is not fordable. The head of the river may be said to be at the spot where Captain Kostenko came down into the valley, being formed by the confluence of several streams viz., the Sel-Sai, the largest of them, which pierces through the southern range (Goh), and flows in a north-western direction; the Kouindy, which flows west; the Suk-Sai, which falls into the Muk-Su, bearing a course towards the south-west; and finally, the above-mentioned Ters-Agar, which comes in from the north. The valley of the Muk-Su extends from east to west, with a slight southing (5°).

This valley preserves the same character for 27 miles, as far as the Hoja-t-äb "tuga," after which it contracts, and the road passes over the mountains, where the path, according to the natives, is not practicable to horsemen, on account of the boulders. The river passes into Karateghin, where it joins the Kizyl-Su, and combines in forming the Surkh-äb affluent of the Oxus.

Captain Kostenko claims to be the first European who has obtained a sight of the head-waters of the Muk-Su River. The valleys of the Kizyl-Su and of the Muk-Su are totally different in character. The first-named river is much longer than the second, and right up to the Karateghin territories it flows through a valley widening out 13½ miles, and carpeted with grass over its whole extent. The river is not deep, and is fordable at all points as far as Daraüt-Kurghan, *i. e.* throughout a length of 67 miles.

The Muk-Su, on the other hand, has not so great a length, but is a larger body of water, and is not fordable. The valley of this river is much narrower, and is walled in by wild, almost precipitous mountains, the bottom of the valley is mostly covered with boulders; the colour of the water is opaque from its lime-bed. The bottom of this valley at the point to which Captain Kostenko descended is 8100 feet above sea-level.

It is difficult to determine which of these two rivers is to be taken as the main head-water of the Surkh-äb. It were, perhaps, more correct to state that the Kizyl-Su and the Muk-Su equally combine within the Karateghin territories to form the great river, which flows into the Oxus.

On the 5th of September, the entire force was moved towards Great Karamuk.\* The road to Great Karamuk—19 miles—follows

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\* Abdul Medjid evidently passed here and up the Kok-Su, over the Tarak (comb) Pass, into Kokand.

the right bank of the Kizyl-Su. After narrowing to the dimensions of a defile in the vicinity of Daraùt, the valley widens, and the river, receiving a large quantity of water from the mountains, is not fordable below the mouth of the Kok-Su—10 miles below Daraùt-Kurgan.\* It runs in a great number of arms, the principal stream being from 70 to 105 feet wide, with a very rapid current.

Here the mountains decline; the rich meadows in this locality attract masses of Kirghiz, whose winter quarters are scattered all over the place. The river is fringed with trees. On the southwest the valley is bounded by low mountains, with a pass, which is visible from Karamuk. The Russian force encamped at the foot of these mountains. Here the valley is 6900 feet above sea-level.

The shortest and most convenient road from Karamuk to Kokand lies up the Kok-Su River (right affluent of the Kizyl-Su). In order to enter the valley of the Kok-Su from Karamuk, it is necessary to traverse a pass over the Gurundu Mountains, which are of no great height, and which are a spur of the main Alai Range. The most direct route into the Kok-Su Valley, over the Gurundu, is about  $12\frac{2}{3}$  miles, of which  $6\frac{2}{3}$  miles are taken up in the ascent, the remaining 6 miles being descent. The road first conducts over the terraced bank of the Kizyl-Su, which is under cultivation for barley and wheat, and then leads into the wide Djeniké defile, through which runs a stream of the same name, falling into the Kizyl-Su, on the right. A series of Kirghiz winter habitations stretches through the defile. Notwithstanding the squalid aspect of these habitations, the evidences of man's presence is gladdening. Here the picture is embellished with fields of wheat, barley, and lucerne (*dj-nushka*), and each hut is distinguished by one, two, or three willow-trees or poplars, which give building material, such as poles for ceiling, logs for doors, &c. A peep into any one of these hovels impresses one very painfully with the wretchedness of Kirghiz life; they are more like pigsties than habitations for man; and yet a sight of a Kirghiz settlement is a great relief to the eye. We see here, at all events, an attempt to pass from a wandering life to a settled form of existence, and anything in the form of a dwelling is pleasing to behold.

The pass over the Gurundu is not difficult; the mountains are of soft formation, and are not steep. The summit of the pass is at an elevation of 9509 feet. The descent is equally easy, but the

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\* Below this fort the Dasht-i-Alai (Alai Steppe) comes to an end, and the locality is simply that of the Alai.

bottom of the defile being choked with stones, which have rolled down, the road passes over a rugged surface. The stream falling into the Kok-Su, disappears under these piles of stones, and emerges only at its mouth.

On the 11th September Captain Kostenko advanced at 8 A.M. to Kara-Kazyk Pass. The pass leads all the way over piles of stones which have fallen from the rocky sides of the Kara-Kazyk defile. These sides are precipitous and grand. In some places they overhang the path. The torrent sweeps, with a tumultuous noise, over the obstructing boulders, and near its mouth it falls in picturesque cascades. The wildness and imposing grandeur of the scenery in the defile increases as one ascends the course of the torrent. The rocks are steeper, and the peaks more pointed; the path, however, does not lead by any dangerous ledges, but runs over a soft soil. Within 2 miles of the summit of the pass, there is a very steep ascent to the top of the main ridge, and the path is zigzaggy. The pass was covered with snow, which lay on the mountain sides, 2 miles below the crest. The reflection of the light was blinding. For pack-animals and for weak horses this pass is somewhat dangerous, as was evidenced by many a carcass lying in the precipices. The summit of the pass is at a height of 12,600 feet; the crest is very narrow, having the appearance of a wall about 28 inches thick. It is formed by a sort of opening (about 35 or 42 feet wide) between a couple of peaks cloven into a comb shape. The crest of the *Tarak* in the Alai Range, further west, is probably the same, *tarak* meaning comb.

The Kara-Kazyk Pass has received its name from a high peak visible to the left, which, in some degree, bears a resemblance to a stake (*kazyk*). Kara-Kazyk signifies black-stake. The view from the top of the pass is very striking by its wild grandeur. A mass of rocky ridges and peaks, crowded together in the greatest disorder, form a remarkable picture of dreadful chaos. Some of these ridges and peaks wore, as it were, a shroud of snow, which glared most painfully in the sun: those on the north were as yet free from snow, and wore a greyish or brown hue.

Shah-i-Mardan, which Captain Kostenko reached on the night of the 11th of September, is celebrated for the loveliness of its situation. It nestles in a pretty spot at the opening of several defiles, and as it is not confined by high mountains, the view from Shah-i-Mardan is varied and charming.

The beauty of the scene is greatly enhanced by the animation imparted to it by a scattering of hamlets, and by fields and gardens in the hollow of the river, and on the undulations.



It may not be difficult to imagine the effect produced, after a long sojourn in a wilderness occupied by nomads alone, by the aspect of this lovely settlement, the houses of which were drowned in a sea of gardens with towering spiral poplars.

From Shah-i-Mardan Captain Kostenko proceeded, on the 13th of September, to Vadil. The road follows the left bank of the stream. The mountains decrease in height very considerably, and the defile is tolerably wide. A continuous chain of hamlets stretches from Shah-i-Mardan to Vadil, 15 miles, in the hollow; there is a break only within a short distance of Vadil, where the rocky mountains close in, and where the road passes over broad ledges. It is a cart-road all the way. At Vadil the mountains fall away much more, and the defile comes to an end, so that Vadil blocks the entrance.

Vadil is in the Ferghana Valley, and is the first populated place of large dimensions at which one arrives coming from the Alai. It is situated at a height of 3000 feet, and lies embedded in a mass of luxuriant and shady gardens.

[The Paper will be published *in extenso*, in the 'Journal,' vol. xlvii, accompanied by an emended table of elevations by Captain Kostenko.]

Colonel H. YULE said the Russians seemed to attach a great deal of importance to the discovery of the so-called meridional range, but Lieutenant Hayward had described the same mountains seven or eight years ago, and, after him, Captain Trotter stated that the eastern portion of the Pamir was bordered by a very high, snowy chain of mountains, running from north to south. The Russian Expedition had attached a factitious importance to this, recalling the ideas of Humboldt, and going back to the views of Ptolemy, and they proposed to call the range, after the great patron of Geographical science in Russia, the Constantine Range; but if it had to be called after the great pillar of geographical science at the time of its discovery, it should rather have the name of Roderick or Henry! It was said in the paper that Ptolemy described the Imäus as a meridional range (*i. e.*, running from north to south), and as distinct from the mountains to the south and north of it; but the fact was that Ptolemy's authority, so far as it went, was just the other way. Ptolemy called all the mountainous region by the same name—"Imäus"—which was merely a Græcising of the word Himalya, or whatever was the form of that name in his day. The real, prominent distinction between these two parts of the great elevation of Central Asia was not physical, but historical. The Himmalyas proper had been in all history the great impassable barrier between Central Asia and India, while the Pamir had been the great *col* or hill-passage between Western and Eastern Asia—between Asia inhabited by Persian and Turkish races, and Asia inhabited by the races from time to time subject to the Chinese Empire. In fact the Pamir was a sort of sea-wall, against which the ocean of Chinese domination had beaten again and again in the course of the last three thousand years. What Ptolemy said about it was probably the most interesting part in the dry bones of his geographical tables. In the introduction to his Geography, when discussing the length of the habitable earth, not having many data at hand, he quoted the account of the journey of a certain Macedonian merchant,

Mæses Titianus, who went to China for silk. Mr. Michell alluded to this, and spoke of the approach to Kashgar as having been from the north. That was an old idea, but an entirely mistaken one. Of late years a perfect key had been discovered to this journey of Ptolemy's merchant, for he mentioned that after leaving Bactra (or Balkh) they travelled somewhat to the north, and entered the hill-country of the Comedæ. It was now known from the Chinese travellers, who had been translated by the great French scholars within the last twenty or thirty years, where the exact position of the Comedæ was. The district was described as having Shignan to the south, Khotlan to the west, and the Oxus along the south-west. The position of London on the Thames could not be described more exactly, and that fixed the position of the Comedæ in what was now Darwaz and Roshan. From the hill-country of the Comedæ the merchant went somewhat to the south, and then turned up a great gorge which led him to the "stone tower," traces of which would probably be found when the hill-country of Shignan was better known. Thence he crossed the Imaus into the empire of China. So far, then, as Ptolemy's authority bore on the physical history of this isthmus of mountains, it was in favour of its identification with the Himalya; though his authority in that respect was not worth much. The Russians, too, seemed to desire to return to the old name of Bolor. Their proof of the name seemed to be something like Jack Cade's proof of his Mortimer ancestry. His putative father being a bricklayer, Jack's friend Smith, the weaver, says, "Yes, and he built the chimney of my father's house, and the very bricks are there to this day to testify thereof: therefore deny it not!" The name "Bolor" arose entirely out of a mistake, and he hoped it would not be used again, merely because it had been found that there was a range of mountains running from north to south.

One thing further he would remark, that had struck him in connection with the name of the Muk-Su, which the Russians had described as a tributary of the Surkhab, the great northern branch of the Oxus, because it curiously illustrated how different was the fate of truth and falsehood. In that fictitious narrative which caused so much discussion some years ago, this region was crossed and recrossed by an imaginary traveller who gave many names. Since then new names had been learnt and old ones recovered, but none of the names mentioned by the German traveller had been recovered. The name "Muk," however, occurred in the history of the Mogul Emperors. The Emperor Humayun had a rebellious brother who was sent into banishment, and made Nawab, or whatever it was, of Karategin and *Muk*. Probably that name of Muk had hardly ever been heard since the sixteenth century until within the last two or three years. Thus the real name turned up in the real country, while the false names were heard of no more.

Sir H. RAWLINSON said he had very little to add to what Colonel Yule had said. There were a few points upon which he did not entirely agree with Colonel Yule, but generally he was in accord with him upon this subject. His recent inquiries had led him to the conclusion that the real route of Ptolemy's merchant was up the Surkhab. All the late Russian surveys had been in the north-east portion of the Pamir, about one-third of which they had crossed, and their approach in that direction had not unnaturally excited a good deal of interest, and perhaps apprehension, in India; but he thought the result of the survey had been to show that that line of country was quite impassable by an army; though it was an easy enough country for the Kirghiz to pass over. He felt bound also to protest against the idea that the Kirghiz were of Aryan derivation. If ever there was a pure Turanian race it was the Kirghiz; and the notion of their being Aryans was one of Klapproth's paradoxes, like his fable of the identity of the Irrawaddy with the great river of Thibet. These Kirghiz now possessed the whole of the Pamir, and found

it very easy to travel over in all directions, but it could not be crossed by an army. It contained, indeed, no supplies whatever except herbage in summer. If ever the Russians approached the Valley of the Oxus—which was a very rich and attractive country—it would most assuredly be by the line of the Surkhab or the great Wakhsh River, and not by the Pamir. Perhaps he would rather surprise Colonel Yule when he stated that he believed that was Ptolemy's old route, and that the famous stone tower would probably be found somewhere in Karategin; in fact it might be the same as the Rasht of the geographers, which for many centuries was the limit of the Mohammedan world. Washgird, which was the capital of this region, was, he believed, at Fyzabad, where there was a river—the Ilek—along which passed the route from Washgird towards Rasht, which latter site would probably be found at Garni. In Timour's campaigns, when they wished to pass from Hissar to Mogulistan, they invariably went up this river, and Baber did the same. Karategin was first mentioned in the wars of Timour, the name being derived from Karategin, a local chief who, under the Samanides, was governor of that country, and who died at Bost, in A.H. 317, and was buried at Isfijab in the famous Robat Karategin. He believed there was a European still living—Colonel Gardiner—who had actually crossed from the Valley of the Oxus into the Alai, along the course of the Surkhab or Wakhsh. In the biography, at any rate, of that extraordinary man, which was published by Sir Henry Durand in the 'Friend of India,' some ten or twelve years ago, it was stated that Colonel Gardiner did actually pass from Badakhshan through Darwaz to the Alai, and if that were so, he ought to have information concerning those countries of the greatest value; but his papers were in such a confused and unintelligible state that nothing worth geographical discussion had ever yet been recovered from them. No doubt the questions of physical geography which arose in consequence of these Russian discoveries were important, but he quite agreed with Colonel Yule that there was nothing very new about them. The so-called meridional range was, he believed, not meridional, but slanted off to the west. Neither was it a separate range, but merely the series of eastern culminating points of the ranges which transected Pamir, and of which the Alai and Trans-Alai were branches.

Sir DOUGLAS FORSYTH said he exceedingly regretted that Captain Trotter, who was more competent than any other Englishman to speak on the subject before the meeting, was not present, but in a short time he would read a paper upon it. He did not want to say much about Ptolemy; in fact he was rather afraid to touch the subject at all, but Heeren, in his 'Researches on Asiatic History,' suggested that between Kasghar and Kokand, over the Terek Pass, and so on to Samarcand was the great route by which the trade from China passed to the west; and certainly the traders would take that route if they were wise, for it was decidedly the easiest.

Sir H. RAWLINSON said that Ptolemy's line passed through Balkh.

Sir DOUGLAS FORSYTH replied that it also went to Samarcand.

Colonel YULE: Never.

Sir DOUGLAS FORSYTH was of opinion that one route did, and went to Kashgar, though it was not Ptolemy's. The officers connected with his mission went from Yangi Hissar across the Pamir to Wood's lake, down to Kilapunja, and back to Yarkand. Captain Kostenko saw the meridional range for a day or two, considered he had discovered it, and called it after the Grand Duke Constantine; but the English Mission at Kashgar before then saw it day after day for about six months, and did not attempt to give it a name; but they learned the actual names of the different peaks. The range was not in so straight a line as it appeared on the map. One peak called Chishtagh was about 25,000 feet high, and another, the Tagarma, about 23,500 feet.

Sir DOUGLAS described, with the aid of the wall-map, the course which the

range took, and said he believed the smaller Kara-Kul was the head of the Yaman-Yar. The Russian travellers spoke of the larger Kara-Kul as having no outlet of any kind, and that matter had given him a great deal of trouble. Everybody he asked about it told him a different story. Some said it had an outlet to the west, others to the east, others that there was an outlet at each end; but nobody ever suggested that it had no outlet at all; and, with all due deference to Mr. Michell's authority, he did not think it had yet been proved that there was no outlet, for Captain Kostenko had not actually been round it. In the Pangong Lake, near Leh a traveller might keep close to the edge, and go almost entirely round the lake, without finding an outlet, but at the west end, in a gorge about a mile below, the water issued forth with as great force as if it came directly out of the lake itself, there being an underground passage. He joined with Colonel Yule in thinking that the word "Bolor" ought to be absolutely abolished, because it was unknown to the present inhabitants of those parts. Some centuries ago, however, a country called Bolor was so accurately described, that the boundaries might almost be walked blindfold.

General R. STRACHEY hoped that all travellers who had their accounts translated into another language would have such an excellent interpreter as Mr. Michell. He entirely agreed with Colonel Yule regarding the general view that should be taken of the mountain-ridges that had been discussed. When a mountain-range was spoken of, it should, first of all, be clearly understood what was meant by the expression. The mountains to which Humboldt gave the name of Bolor were, in reality, nothing more than that portion of the elevated mass of land which formed the barrier between the head-waters of the rivers trending west into Turkistan and those trending east into Central Asia. No one could say to which particular part of the systems of elevation that here united it physically belonged, because no one knew anything about the Thian Shan, and very little was known about the western extremity of the Tibetan high lands, or the northern portion of the Afghan table-land. His own impression was that the mountains which had been referred to in the paper were a prolongation of the Tibetan highlands and the Himalaya. The particular ridge, to which such special importance seemed to be attached by this traveller, was certainly nothing more than a lofty part of the general system of elevation, and apart from it called for no particular notice, excepting as a topographical detail. Captain Kostenko had referred to the dry haze observed in one of the valleys of a tributary to the Oxus, as something very peculiar; but every one who had been in the Himalaya knew that a similar condition of the air was a very common phenomenon there. Along the whole face of the Himalaya during the dry months a wind blew from the heated plains during the day, bringing with it great quantities of dust, and the haze thereby caused entirely obscured the view, and its effects were manifest on the tops of the glaciers at an elevation of 10,000 or 11,000 feet, though not so bad as a London fog. The same dry north-west winds blew with equal violence along the Valley of the Oxus during the hot months, as over the plains of Northern India, and he had no doubt a haze was produced there in the same way as in the Himalayas.

Sir GEORGE CAMPBELL said he had always understood that the Valley of the Oxus was by no means a rich country, and he was therefore surprised to hear Sir Henry Rawlinson speak of it as a region which the Russian would covet.

Sir H. RAWLINSON replied that he did not refer to the immediate banks of the River Oxus, but to the plains on each side watered by the streams descending from the mountains. All the streams running from the Hindu Kush were exhausted by irrigation canals in highly cultivated regions before reaching the Oxus. The district of Kunduz was thus notoriously rich, as was also Kholm, while Balkh was one of the most fertile districts in Asia, only surpassed indeed by Merv. On the northern side, again, the Valley of Kulab

was exceedingly fertile. Where there were large mountain-streams running down into an alluvial valley under a tropical sun, it was a law of nature that there must be fertility. Sir George Campbell was quite right, however, in saying that the immediate banks of the Oxus were comparatively uncultivated, because the irrigation water was all consumed before reaching that point. At the same time the character of the Valley of the Oxus, taken as a whole, was certainly one favourable to cultivation.

The PRESIDENT, in summing up, observed that the paper and the discussion to which it had led, proved that with regard to this part of Asia less was positively and scientifically known than of almost any other portion of the world. Geographers must, therefore, be very grateful for every modicum of real knowledge that could be obtained. Mere general observation was of very little value when such a confused chaos of mountains was under consideration. He hoped that now, when by a new convention with China, the road into Central Asia, Mongolia, and Thibet, seemed likely to be opened up, the Government would take care that any political mission that was sent to these little-known regions would be accompanied by scientific explorers, who could really obtain trustworthy scientific results, and he thought the Society would be perfectly justified in pressing that consideration as one of great importance.

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## ADDITIONAL NOTICES.

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### 1. *The Navigator Islands.* By LITTON FORBES, M.D.

THE annexation of the Fiji Islands by Great Britain has to no small extent altered the political and commercial importance of many of the island groups of the South Pacific. More particularly is this true with regard to the Friendly and Navigator Islands. Both of these groups are in close proximity to the Fijis, and the future of both is bound up with that of the latter. Geographically the three groups form a triangle, the apex of which is Samoa, the base Fiji and Tonga. These groups are almost equally distant from each other, and are moreover connected by language, inhabitants, productions, and now by a nascent commerce. Colonisation has already passed from New South Wales, which was no long time ago the outpost of western civilisation in the South Pacific to Fiji, and from Fiji it is rapidly passing on to the two neighbouring groups. A few years ago the Navigator Islands were known to the world chiefly as the ill-omened spot where so many of La Pérouse's crew were massacred; but to-day they are actually the seat of an important commerce with Germany, and one of the most profitable channels for Australian enterprise. In a few years more, important and difficult problems will have to be solved regarding this group, just as they had to be solved with regard to Fiji. By their position, the three groups of Fiji, Samoa, and Tonga, are well adapted for a confederation. The distance from Ongea, in Fiji, to Vavau, in the Friendly Islands, is not more than 240 miles; while the distance from Savaii to Vavau is about 300 miles. From Vanua Levu, in Fiji, to Savaii, is 420 miles, or 36 hours' run for a steamer. The three groups are not only geographically allied, but also are being peopled simultaneously from the

Australian colonies, by a race of men whose objects and pursuits are identical. Cotton, coco-nut oil, and sugar, are essentially the staple products of the three groups; while the difficulty and importance of the great labour question is felt equally in all of them. English influence is now so decidedly paramount in the South Pacific, that to a great extent it must determine the development and social future of most of the Polynesian islands. But especially will this be the case with regard to those two beautiful, fertile, half-civilised archipelagos that lie scarcely a day's sail from the Crown colony of Fiji. British interference is sooner or later inevitable; and taught by the example of Fiji, it would be better to interfere too soon than too late, and by a timely policy of protection, foster the rising commerce of the groups, and check even the potential abuses of a nascent labour traffic.

On May 3, 1768, Bougainville, coming from Tahiti, saw high land before him in the north-west, and in a position where his chart showed no land. Bearing down upon it, he was met at some distance from the shore by canoes filled with natives. These differed in appearance and language from any he had before seen, and displayed, moreover, an amount of fear and distrust very different from the greeting he had received from the friendly Tahitians. Bougainville describes the islanders as of mediocre stature, bronze coloured, beardless, and tattooed in a strange manner. On the 5th of May he saw other islands belonging to the same group, to which he gave the name of the *Isles des Navigateurs*, from the skill with which the natives managed their canoes. Bougainville did not land on any part of the group, and, indeed, saw little more of it than the island of Tutuila, and the eastern portion of Upolu.

In the early years of this century the Navigator group was occasionally visited by small vessels from New South Wales and by whalers from New Bedford, and there can be no doubt, also, by slavers from Chili and Peru. Sailors and runaway convicts from Van Diemen's Land and Botany Bay also at intervals established themselves on shore, much as they did in Fiji and other groups. The Spaniards do not seem to have visited the islands, or, if they did so, have left no record of themselves, either in the traditions or language of the people. In 1833, Commodore Wilkes, of the United States Exploring Expedition, visited the group, and added considerably to our knowledge of it. His surveys and observations were, however, chiefly confined to the coast; nor did he remain a sufficient length of time to gain any intimate acquaintance with its resources or capabilities.

In 1872 I was appointed by the German Government to take medical charge of their Consulate at Apia, and, during a residence of some duration, enjoyed exceptionable opportunities of becoming acquainted with the topography and natural productions of the group. In my researches I was not a little aided by the labours of my predecessor, Dr. Gräfe, an accomplished naturalist, and by Mr. Grote, surveyor to the firm of Godefroy, of Hamburg, as also by the Admiralty Charts.

The Navigator group lies between the parallels of  $13^{\circ} 30'$  and  $14^{\circ} 20'$  s., and the meridians of  $169^{\circ}$  to  $173^{\circ}$  w. Taking Cape Falealupu, in Savaii, as the extreme western point, and Manua as the extreme eastern, the whole group extends over a distance of about 240 miles, and lies in a direction N.N.W. and S.S.E. It numbers in all thirteen islands, many of which are little more than barren and isolated rocks. The island of Rosa, though generally counted as belonging to the Navigator group, is entirely separate from it. It belongs to a different geological formation, being not a volcanic, but a coral island.

The chief islands of the group, and, indeed, the only ones which present points of either geographical or commercial interest, are Savaii, Upolu, and Tutuila.

Savaii is the largest island of the three, measuring some 40 miles from east to west, by 20 from north to south, and containing a superficies of about 700 square miles. In shape it is nearly circular, and for this reason, perhaps, possesses no harbours of any importance; in which respect it contrasts strongly with Upolu and Tutuila. The little bay of Mataatu, in the extreme north of the island, is the only place where large vessels can anchor; but even it is not safe from November to February.

The interior of the island is occupied by two parallel chains of mountains; one of these runs along the southern shore in a direction east and west, while the other is more centrally situated. On the west and north-west, behind the bay of Safata, these chains approach each other. Wherever, as on the south side of the island, they run close to the coast, they form a precipitous and rock-bound shore, destitute of harbours or reefs. Wherever, on the other hand, they recede from the coast, they leave a strip of alluvial soil of varying breadth, but always covered with luxuriant vegetation, dotted over with native villages, and sheltered by a friendly reef from the perpetual roll of the ocean.

These ranges are in their nature volcanic, and many of their peaks are extinct craters. Especially is this the case with the lofty peak of *Mua*, which rises to a height of 4000 feet, and which I have seen at an estimated distance of 60 miles. In proceeding towards the interior from the district of Aopo, the traveller passes over a tract of country strewn thickly with scorix and ashes, which are evidently of very recent origin. So little changed, indeed, are these evidences of volcanic action, that the native tradition of the last eruption having taken place about 200 years ago is probably correct. In the north-west of the island, in the districts of Sasina and Asana, are also many miles of lava-plains, as yet little altered. They have received from the natives the name of *O le ma*, or the "burnt country," in which name there is, perhaps, a proof that the period of volcanic activity in Savaii was not prior to the arrival of the present inhabitants. An older but larger lava-bed is to be found in the east of the island, and is called by the natives *faasa-leaga*. The soil is here a decomposed lava, and is covered in some places with a scanty vegetation, in others with vast blocks of stone or small fragments of lava.

The interior of Savaii is occupied almost entirely by barren and lofty mountains, interspersed with rock-covered plains. Its sterility has so far been a barrier not only to all settlement or cultivation, but even to the visits of travellers or explorers. These solitudes are destitute of all animal life, are alternately parched by a tropical sun or deluged by fierce rain-storms, and afford neither food nor water. They are more barren than even the deserts of Australia; and more than once, natives, who have attempted to traverse them, have succumbed to fatigue and thirst, and have perished miserably.

In spite of a considerable rainfall, Savaii possesses no rivers, a phenomenon which is due probably to the porous nature of the vesicular lava, of which the island is mainly composed. Along the coast, however, numerous large springs abound. At ebb-tide the fresh water from these may be seen bubbling up out of the sand and on the reefs, and frequently bearing with it leaves and branches, and other vegetable *débris*.

On the northern portion of Savaii, from Falealupu, the coast is rocky, with here and there small bays, at the heads of which are the villages of Papa and Satana, and, further on, Asau. Advancing towards the east, the traveller arrives at Mataatu. This is the only spot along this shore where a vessel can lie at anchor with any security during the trade-winds. The harbour is formed, not in the usual manner by a passage in the reef, but by the reef itself, which runs parallel with the shore, and at some distance from it. It is only safe during east and south-east winds; and should the wind work round at all to the westward, vessels must at once get under weigh.

The scenery of Savaii is in many places very picturesque. The mountains, somewhat barren and gloomy, are by no means destitute of a certain beauty and grandeur. They rise rugged and sheer from a foreground of blue ocean, their bases laved by an eternal surf, their summits wrapt in clouds and storm. Further on their slopes are seamed with deep glens, and covered with a heavy growth of timber. Anon they slope down more gently to the sea, forming a narrow belt of fertile soil, covered with all the luxuriant vegetation of the tropics. Here are lofty groves of coco-nut trees, beneath which the traveller walks in a dimmer light and a cooler atmosphere. Under this friendly shade the natives build their villages, which are mere collections of huts, laid out without any plan, and constructed to last at most a year or two. Savaii, for its size, is sparsely populated. The natives are a somewhat turbulent set of men, fond of war for its own sake, and in skill and valour and determination not inferior to their kinsmen the Maories of New Zealand. To conquer them by arms would be a most difficult matter, as they could always retreat to their mountain-fastnesses, and keep up a guerilla warfare for an almost indefinite period. As already stated, Savaii possesses no rivers, and but one harbour; so that vessels have to lie off and on the coast, and take in their cargoes by boat. A considerable quantity of land on the island has been sold to Americans and Germans, but it is extremely doubtful whether the purchasers could venture to cultivate it while the natives are in their present temper. Foreigners, indeed, have never been particularly welcome in Savaii; and until there is some fixed government in the group, it will be impossible to utilise the latent wealth which the island undoubtedly contains.

In the strait between Savaii and Upolu are the islands of Manono and Apolima, distant from each other about 2 miles. Manono is  $\frac{1}{2}$  miles in circumference, and thickly wooded. The strait that separates it from Upolu is shallow, and almost impassable at low water, and will probably in time, with the growth of coral, become perfectly dry. This island, in spite of its small size, has played a conspicuous part in the political history of the group. It has long been the stronghold of the feudal aristocracy of Samoa, and a focus of native politics. This is to be attributed to the possession by its inhabitants of the rock of Apolima, which lies close to it, and is evidently the crater of an extinct volcano. It is about 470 feet high, and accessible only at one spot on its northern side. Should any European power take possession of the Navigator group—as sooner or later will be the case—these two islets would form important points in any system of defence. If fortified by modern appliances they would be well-nigh impregnable, and, from a military point of view, might prove the key to the whole group.

The Island of Upolu, the second in point of size, but the first in point of fertility and population, lies to the south and east of Savaii. It is 37 miles long, 11 broad, and contains a superficial area of 550 square miles. Its interior is occupied by a chain of mountains of volcanic origin, but without the lava-beds of Savaii. The hills are, as a rule, thickly wooded to their summits. Towards the north the range slopes gradually, but towards the south it continues rugged and abrupt, and consists chiefly of great dome-shaped masses of basalt. At about 4 miles from Apia the whole range becomes lower, and gradually trends away towards the sea. Along this coast to the west and north is an unbroken coral-reef, with frequent openings, which correspond to clefts in the range. On the south of Upolu, owing to the greater steepness of the mountains, the coral-reef is either absent or very much disjointed. On the west the central range terminates in a beautiful and fertile plain, from which rises a lofty volcanic peak called Tofua.

From its shape and small extent, Upolu cannot possess any large rivers. The largest and most constant streams are the Sigato Vailoa, the Latonga, and the Nafata. These, properly speaking, are mere mountain-torrents,



and not navigable even by canoes. As they come down from the hills they form in their course numerous cascades, some of which are very conspicuous objects when seen from the sea. One in especial at the back of Apia, is some 300 feet high, and forms a good guiding-mark to vessels entering the harbour.

In the centre of the island, on the summit of a volcanic peak, is the remarkable lake of Lanuto. The best way to reach this is from Vaiuso. After a weary climb of some hours, cutting his way through a tangled undergrowth, and walking in an atmosphere as warm and moist as that of a hot-house, the traveller, suddenly emerging from the forest, finds himself at the shore of a lake. The lake lies about 120 feet below the edge of what was once a crater, and has a depth of 60 feet. It has no apparent outlet, or no continuous supply of water, and is probably sustained entirely by the rainfall, which, during one portion of the year, is very considerable. The foliage immediately round the lake is of great variety and beauty. Many legends are connected with the spot, and one Samoan poet commemorates its perennial verdure in some pretty verses, beginning

“Lanuto e le toi a e lan mea.”

Lanuto, untouched by withered leaf.

Between Matautu and Moolinoo, at the head of an oval bay, lies Apia, the chief town of the island. It is prettily situated, having a background of mountains thickly wooded, and a foreground of harbour and coral-reefs. The harbour consists of two portions, the most westerly being the best for vessels that intend to remain for any length of time, especially during the rainy season. It is, perhaps, the best in the group for sailing-vessels, affording as it does good shelter, and being, moreover, easy to enter and to leave. Some precautions are, however, necessary to be observed. The high land at Wailili, some 3 miles higher up the coast, bears a great resemblance to the land at the back of Apia, and, indeed, has been mistaken for it. Wailili, too, is reached through a passage in a reef, and has, moreover, a waterfall on the hill above it. Many vessels have thus been nearly lost, as Wailili is a blind harbour, and ends abruptly in a wall of rock. A strong current sets past the entrance of Apia Harbour, so that vessels entering should never allow themselves to go to the westward of the passage. On entering or leaving the harbour a steady breeze is absolutely necessary, as there is always a heavy sea at the entrance. On one occasion I saw a vessel—which was momentarily becalmed in the passage—drift among the breakers, and become a total wreck in less than twenty minutes. Notwithstanding these disadvantages, Apia Harbour is by no means a bad one. It is as good as Levuka in Fiji, and certainly superior to the roadstead at Tongataboo.

Passing down the coast a succession of beautiful bays are met with. At the distance of from half a mile to two miles from the shore a coral-reef protects this portion of the island for nearly twenty miles. At high tide canoes and boats can pass between this and the mainland, and thus a great deal of the insular traffic is carried on. The coast lands of this portion of Upolu are thickly wooded to the water's edge. Timber trees, some of them as hard and durable as teak, alternate with the coco-nut, the bread-fruit, the orange and the lime; while beneath the shade of these is a thick undergrowth of such plants as wild cotton, sago, arrowroot, turmeric, and many others. In most places the shores are sandy, and formed from the *débris* of the coral-reef. The depth of water is unfortunately very limited, so that vessels cannot pass between the reef and the mainland. This district is the most fertile in the Navigator group. It is at present, owing to tribal wars, to a great extent uncultivated, but, judging from the luxurious vegetation that the rich, black soil now supports, its productiveness would be almost inex-

haustible. The forest in this part is the habitat of that strange bird the "Manu mea," or *Dilunculus strigirostris*, the nearest living relative of the extinct Dodo. The Manu mea used at one time to frequent the forests of Upolu in great numbers, but the natives have now learned its value, and are always on the look-out to capture it or its young. Its numbers are rapidly decreasing, and it will probably soon be extinct. A fully-grown bird even now fetches in Apia about 7*l*. sterling, and probably not more than two or three can be captured in a year.

To the west of Aana is the village of Falealili, one of the largest native towns in Upolu. Its inhabitants have a feudal claim to the allegiance of the people of Tutuila, to which island they pay annual visit, called *Malugas*. It was during one of these visits that La Pérouse arrived at Tutuila, and so far as can now be learned, it is almost certain that the massacre of his boat's crew was carried out by a few chiefs from Upolu and their followers, and presumably from Falealili. The country about Falealili is stony and unproductive, but nevertheless yields coco-nuts and bread-fruit.

At the extreme eastern end of Upolu are two small islands—Nuute'e (big coco-nut) and Nuulua (two coco-nuts)—of little importance in themselves, except as landmarks, and as affording strong points for the erection of fortifications. During my stay in the group they were both purchased from the natives by an American, who proposed to stock them with sheep.

Passing down the coast from Nuulua the bay of Fangaloa is reached. It is a treacherous harbour, and affords a very precarious shelter. Saluafata is a pretty little town at the head of a small bay. It is surrounded by groves of coco-nut trees and by an amphitheatre of hills thickly wooded. Some excellent land here stretches inwards from the coast, but is at present quite uncultivated. Below Saluafata is Wailili, a German cotton-plantation, where some 300 Polynesian labourers, principally from the Caroline Islands, are annually employed.

From Wailili to Apia the country is thickly wooded and the land is excellent. A coral-reef here runs parallel with the shore at a varying distance, and affords boats an easy and safe way of passing up and down the coast. At one time there were numerous villages between Wailili and Apia, as is shown by old walls of houses and tombs. The whole district has many times been laid waste by war, but, under proper cultivation, would be capable of great things.

As seen from the sea there are not many islands in the Pacific that present a more beautiful or picturesque appearance than Upolu. La Pérouse, indeed, held that it must be counted amongst the largest and finest of the South Sea Islands. Though not so high as Savai by 1000 feet, it shows, nevertheless, a bold and majestic front. Its central range is not less than 3000 feet high, and is wooded almost to its summit. High up, indeed, the trees are small and stunted, and the undergrowth thin. But with every foot of descent the vegetation changes rapidly in character until within a short space the forest becomes thoroughly tropical. Trees of a hundred different species struggle with each other for light and air. They meet overhead and form a leavy canopy through which the rays of a vertical sun strive in vain to pierce. Beneath this the traveller walks in a dim twilight. Around him all is moist, damp, and decaying. The air is sickly and oppressive, the grasses rank and matted, and from every trunk and bough snake-like creepers and supple vines hang down and encumber the ground. On the stems and branches of the trees are clustered rare ferns and orchids that would be the glory of an English hot-house. Here they grow luxuriantly on the moss-covered bark and dead wood, and reck little of sunlight or fresh breezes. The ground in many places is covered with flowers as with a carpet, while in others it is overgrown with a dense and impenetrable mass of underwood. Such is the usual charac-

ter of vegetation of Upolu. It is throughout a very fertile island, and fully equal to the best portions of the Fiji group. It produces already considerable quantities of coco-nuts and cotton, although but little has been done in the way of scientific cultivation. The hill-sides on the northern aspect of the island, if cleared of their forests, would afford a magnificent section of country, and from their position should be admirably adapted for the growth of coffee. The rich, black loam and warm moist climate of the lowlands already grow sugar-cane and tobacco, but as yet neither skill nor capital has been brought to bear on their cultivation.

The natives of Upolu are hospitable and friendly to a degree, much more so, in fact, than the natives of either Savaii or Tutuila. They are all nominally Christian and have abandoned most of their heathen rites and customs. They are willing to sell land, and have already parted with more than 100,000 acres, principally to American and German purchasers. The price varies a good deal according to the necessities of those who sell, but may be said to range from a few pence in the mountainous districts to about 17. an acre near the sea-shore.

Tutuila, the Maouna of La Pérouse, is geographically the most central island of the group, and lies about 40 miles south and east of Upolu. It is 17 miles long and 5 broad. On its southern side is the deep bay of Pago-pago, which almost cuts the island in two. This harbour, which is one of the best in the whole South Pacific, is surrounded by hills of from 2000 to 3000 feet high. Surrounding the harbour at their base is a small strip of level land, upon which the native villages are built. This would be admirably suited as a site for a wharf or for the storage of coal, and a portion of it was actually purchased with this object by an American company in 1872. The harbour of Pago-pago is half-a-mile wide at the entrance, and runs north and south for the distance of a mile, when it turns in a westerly direction, and opens out into a fine sheet of water. It is somewhat difficult for sailing-vessels to leave, in consequence of the trade-wind blowing directly into it; but for steam-boats it is unsurpassed by any harbour among all the island groups of the South Pacific. Here vessels of any size can lie at anchor secure from every wind all the year round. It is well adapted as a coaling-station or for refitting and repairing ships, and affords, moreover, plentiful supplies of timber, food, and water. It was here that Captain Mead, of the United States navy, in May, 1872, hoisted the American flag, and, under a treaty with the chiefs, took possession of the place. I am not aware whether his Government subsequently sanctioned this proceeding, which was much criticised at the time, and gave rise to a good deal of speculation in the Australian colonies.

The central portions of Tutuila are occupied by a mountain-range, the highest point of which is Matafua, some 2300 feet above the sea. The whole island is evidently of volcanic origin, and is well wooded almost to its summits. The tree-fern and the coco-nut are the prevailing species; but there is also much useful timber, and an abundance of bananas, pine-apples, and other tropical fruits. The small island of Anuu, 300 feet high, and with a population of 200 inhabitants, lies half-a-mile off the coast. Passing westward, numerous small bays are met with, some of which rise above the dignity of boat-harbours. Not far from Vatia is Asu or Massacre Bay, the scene of the deaths of MM. De Lamanon and De Langle, and a boat's crew. As related by La Pérouse, the massacre seems to have been entirely unprovoked by any violence on the French side, while such acts are quite foreign to the usually friendly and hospitable people of the group. The natives say that the actual murderers did not belong to Tutuila, but had come on a *maluga*, or political mission, from Upolu, which at that time and still claims a feudal supremacy over Tutuila.

From Asu to the extreme west of the island, the coast presents much the

same character everywhere, and is high, steep, and inhospitable, or broken occasionally by small bays, which afford shelter to native canoes, and at the head of which are native settlements. Tutuila, indeed, possesses few points of geographical interest. It is destitute of rivers or lakes, while its interior is possessed by a single mountain. Its scenery is in many places grand and picturesque, especially on the west side. But the possession of such a harbour as Pago-pago renders it important both commercially and politically, while the island itself is actually capable of a great deal of development, if only capital were at hand. There is no reason, apparently, why it should not grow cotton and coffee, while even now its production of coco-nuts is very considerable. Its inhabitants are not so friendly as those of Upolu, and have shown a great aversion to parting with their lands to white settlers. At present the only export from Tutuila is *cobbra*, and this is entirely in the hands of the Germans.

To the east of Tutuila lie the three last islands of the group, Manua, Oloosinga, and Ofu. They possess little interest, either geographically or commercially. They have no harbours, while their interior is mountainous and unproductive. The culture of the coco-nut, which is almost the sole food of the natives, here assumes great importance. There is a native tradition that Manua is the spot whence sprang the whole race of the Samoans; and in this tradition may possibly linger a record of that migration which, following the course of the trade-winds, brought the first inhabitants to the Navigator Islands.

Ethnologically the Samoans belong to the same stock as the Maories of New Zealand and the Kanakas of the Sandwich Islands. They are representatives of the so-called light race of the Eastern Pacific; but have evidently intermixed in many cases with the swarthier tribes of Fiji and Tonga. Physically they are a fine race of men, are possessed of considerable mental ability, and are capable, under favourable circumstances, of great improvement. They have for ages been semi-civilised, but have never succeeded in advancing beyond a certain point. They have a system of social government which closely resembles the feudalism of mediæval Europe. They have an exact and elaborate code of laws to regulate the inheritance and transmission of land, which descends as a rule through the females of a family. The power of the great chiefs is very considerable, but not so absolute as in Fiji and Tonga. It is practically limited by certain wise, understood rules, and by the power of any individual chief to command obedience. Judged by the standard of other Polynesians, the Samoans will take a high position. They are less ferocious than the Fijians, and more active and energetic than the Tahitians. Of late years, however, a great change has passed over them. They have abandoned many of their native industries, and have learned not a few of the vices of civilisation. A succession of civil wars has damaged the material prosperity of the country and demoralised its inhabitants. These wars are generally about some question of precedence among the leading chiefs, and are carried on with great cruelty by both sides. No quarter is given or asked, and wounded prisoners are beheaded as soon as captured. During the last war the natives substituted breech-loading rifles and artillery for their ancient club and spear, and showed considerable skill in the construction of earth-works and fortified camps.

At present the islanders enjoy an autonomy, but this evidently cannot last very long. Every day the amount of capital invested by Europeans in the group is increasing. Hitherto this has been almost entirely in the hands of Germans, but now there are unmistakable signs that this will be no longer the case. The annexation of Fiji has drawn increased attention to the fertility and wealth of the Navigator group, which is only a day's sail distant from it. The stream of colonisation from Australia has already commenced to flow towards Samoa, which will before long of necessity attract more attention. Then the

same problems that presented themselves for solution in Fiji will present themselves once more in Samoa. The labour-trade will again demand attention, and perhaps legislation. In spite of herself, it is inevitable that England will have to interfere sooner or later with this group. It belongs to Australia geographically, and is too valuable and too close to our colonies to be allowed to pass into other hands. The natives are thoroughly weary of the anarchy and civil wars which for the last generation have distracted their country. They would gladly welcome the interference of a strong power, that would settle all differences between rival chiefs and compel a policy of peace. The geographical position of these three groups of Fiji, Tonga, and Samoa, with regard to each other, at once suggests the idea of a Federation. Those who know the natives best know also that some such measure would meet with their hearty approval. It is indeed inevitable, sooner or later; but were it done at once, most of the difficulties which were encountered in dealing with Fiji would be avoided from the outset. The group itself would benefit by the change, the Australian colonies would be secured from a possible danger, while a new field would be opened up to capital and enterprise. The annexation of Fiji has rendered a further interference with the two neighbouring groups of islands almost a logical necessity. It cannot in the nature of things be long avoided, and the sooner it is undertaken in the interests of civilisation, of our Australian colonies, and of the natives themselves, the better.

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## 2. *The Two Providence Islands.* By W. NOEL SAINSBURY.

At the request of Major-General Lefroy, Governor of the Bermudas, who had considerable doubts about the history of the Island of Providence, east of the Mosquito Coast, Mr. W. Noel Sainsbury, editor of the 'Colonial Calendar of State Papers,' has been at some pains to elucidate the subject, which proves to be as important as it is interesting, and clearly shows that General Lefroy had good reasons for his doubts; for it is now certain that both the early history and the geography of that island have hitherto been much confused, and, indeed, mixed up with those of an island of the same name, viz., Providence, one of the principal islands of the Bahamas.

On the 4th of December, 1630, King Charles I. granted to the Earl of Warwick and others two islands. These islands are described in the Patent as Providence, "heretofore called by the name of Catalina," and Henrietta, "heretofore commonly known by the name of Andrea," lying between 10° and 20° N. lat., and 79° and 81° W. long., and both these islands will be found in the map between 12° and 14° N. lat.

Now there are preserved in the Public Record Office two contemporary MS. volumes of the proceedings of the 'Company of Providence Island,' one a journal, the other containing a copy of their Patent, also Commissions, Instructions, and Letters, to their Governors and other officers in the said Islands from 1630 to 1641. In the year 1641, Providence Island was taken by the Spaniards and the English were expelled; and this will account for the record of the English Company's proceedings abruptly terminating in that year. The Spaniards "carefully garrisoned" the island, and seem to have kept possession of it until 1666, when Captain Mansfield surprised and retook Providence Island for the King of England. The Governor of Jamaica then sent Major Samuel Smith with a small supply of men to govern Providence Island for his Majesty, who, in November, 1666, appointed Sir James Modyford, brother of the Governor of Jamaica, by Letters Patent, Governor of the Island of Providence, *alias* Sta. Catherina. Before sailing from Portsmouth, Sir James Modyford memorialised the English Government for certain arms and ammunition with which

the said Providence Island "must be furnished, or on occasion it may be lost else for want thereof, as it was in anno 1641." When, however, he arrived at Jamaica, Providence had been retaken by the Spaniards, and it was not before April, 1671, that the island was "again possessed by the English privateers on their way to Panama," and that Sir James Modyford "then thought himself bound in honour to go and take possession for his Majesty."

Let us now inquire into the early history of Providence, one of the principal islands of the Bahamas. There is no record of a grant or settlement of this island before 1670. On the 1st of November, in that year, King Charles II. granted to the Duke of Albemarle, Lord Ashley, and others, "all those islands called Bahama, Eleuthera, Providence," &c., which islands are described in the Patent as lying between  $22^{\circ}$  and  $27^{\circ}$  N. lat., "commonly known by the name of the Bahama Islands, or the Islands of the Lucayas." It appears, then, that there were two separate and distinct grants of two islands of the same name; one dated the 4th of December, 1630, the other the 1st of November, 1670. The limits of each grant are, however, as we have seen, clearly defined; the Providence Island, granted to the Earl of Warwick in 1630, lying between  $10^{\circ}$  and  $20^{\circ}$  N. lat., while the Providence Island granted to the Duke of Albemarle in 1670 was between  $22^{\circ}$  and  $27^{\circ}$  N. lat. It is curious that there should be included in both these grants another island of the same name, viz., Andrea or Andros.

There were no records in the Public Record Office relating to any of the Bahama Islands before a colony was regularly established there in 1717, until the present Earl of Shaftesbury generously presented his valuable Collection of Papers to that office. In this Collection, however, are some papers about the first settlement of Providence Island, and among them letters written between 1671 and 1675 from Lord Ashley (the first Earl of Shaftesbury) to Captain John Wentworth, who was appointed by the patentees Governor of Providence early in 1671.

How the early history of these two islands of Providence became so confused is not easy to be explained. In the year 1842, a large collection of the Board of Trade papers was transferred, by order of the Secretary of State for Foreign Affairs, to the State Paper Office, and in a Catalogue of this Collection the two MS. Books of Entries aforesaid (1630-1641) of the proceedings of the Company of Providence Island were placed with the Entry Books of the Bahama Islands, and have been so indexed in the 'Colonial Calendar of State Papers' printed in 1860. This, however, is now discovered to be a mistake, for neither of these volumes has anything whatever to do with the history of any of the Bahama Islands, but clearly relate to distinct and separate islands lying east of the Mosquito Coast, and which, as we have seen, were sometimes in the possession of the English, and sometimes occupied by the Spaniards, but which now belong to New Granada. Printed books—gazetteers as well as histories—have been consulted about this strange medley, and the mistake frequently occurs, viz., that Providence in the Bahamas was settled from 1629 to 1641 by the English, when the Spaniards expelled them. The 'Colonial Office List' for 1876 prints the same account. It is curious that Johnston's 'Gazetteer,' a recognised authority at the Foreign Office, has two conflicting accounts of this adventurous island. Thus "Providence" is described as in the Caribbean Sea, 100 miles east of the Mosquito Coast, lat.  $13^{\circ} 21'$  N., long.  $81^{\circ} 22'$  W.; length, 10 miles; breadth, 4 miles. *It is fertile, but uninhabited*; while "Old Providence" is described as an island of the Caribbean Sea belonging to New Granada, 100 miles east of the Mosquito Coast, lat.  $13^{\circ} 21'$  N.; long.  $81^{\circ} 22'$  W.; breadth,  $2\frac{1}{2}$  miles; length,  $4\frac{1}{2}$  miles. Population (1845), 342, who speak mostly English.



PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED MARCH 23RD, 1877.]

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SESSION 1876-77.

*Fifth Meeting, 22nd January, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Emil Brass, Esq.*

ELECTIONS.—*Reuben Vincent Barrow, Esq.; Rev. John Barton; Commander Lewis A. Beaumont, R.N.; Right Hon. Sir Richard Couch, Knt.; Godfrey Darbshire, Esq.; Rev. George De Vitre, M.A.; J. M. S. Fogo, Esq. (Surgeon-General); Bartle C. A. Frere, Esq. (Lieut. Rifle Brigade); R. William Galbraith, Esq., C.E.; Abraham Goodall, Esq., M.D., &c.; F. B. Halford, Esq.; Evan Herring Hare, Esq.; Commander R. P. Jenkins, R.N.; Sir J. J. Trevor Laurence, Bart., M.P.; Henry Lee, Esq., F.L.S., F.G.S., &c.; F. G. Luck, Esq.; Capt. Colin Mackenzie; G. J. J. Mair, Esq., F.S.A.; Charles Henry Marten, Esq.; Samuel Mendel, Esq.; Edward S. Morris, Esq., F.Z.S.; William Irving Page, Esq.; Lieut.-Colonel George Massey Payne; Cecil Colin Pitcairn, Esq.; Capt. William John E. Poole; Oswald Milton Prouse, Esq.; Fleetwood Sandeman, Esq.; Charles Seely, Jun., Esq.; E. Louis T. Smith, Esq.; Robert A. Sterndale, Esq.; W. E. M. Tomlinson, Esq., M.A.; J. H. B. Warner, Esq.; Samuel Francis White, Esq.; Henry Francis Redhead Yorke, Esq.*

DONATIONS TO THE LIBRARY, JANUARY 8TH to 22ND, 1877.—*Reise in Nordost Afrika, von Th. von Heuglin; 2 vols., Braunschweig, 1877 (M<sup>me</sup> Kieser, the deceased Author's sister). Records of the Geological Survey of India, vol. ix., pt. 4, 1876 (The Geological Survey). Ostriches and Ostrich-farming, by Julius de Mosenthal and J. E. Harting, 1877 (M. de Mosenthal). Die Bedeutung Tripolitanicus*



als Ausgangspunkt für Entdeckungsreisende, von G. Rohlf's; Weimar, 1877 (*Author*). Spedizione nell' Africa Equatoriale de Conte Pietro di Brazzà-Savorgnan, di F. Nardi; Roma, 1876 (*Author*). South Australia. Statistical Register for 1875; Return by R. Hickson on navigability of Murray Mouth; Sections of Port Adelaide Creek, by Lieut. Goalen; Report by F. Howard on Australian coastline and ports; Improvement of Semaphore Harbour; Report from Public Works Department for 1875; and Return of Progress of S. Australia, 1870 to 1875; Giles's Explorations, 1875, and Journal of Mr. Lewis's Lake Eyre Expedition, 1874-5 (*The S. Australian Government*). Victoria. Statistical Register for 1875, part vii. (*The Victorian Government*). Tasmania. Mr. Sprent's Report on country round Mount Bischoff (*H.M. Sec. of State for Colonies*). The Ottoman Empire and its tributary states, by Capt. W. S. Cooke, 1876 (*H.M. Sec. of State for War*). Classification de 250 fécules, par — Bernardin; Gand, 1876 (*Author*). Hakluyt Society, vol. LIV. of publications; 2nd ed. of Barents's Voyages, by Lieut. Koolemans Beynen, 1876 (*The Hakluyt Society*). The Gold Regions of South-Eastern Africa, by the late Thomas Baines, 1877 (*R. White, Esq., F.R.G.S.*). Annual Report of U.S. Geological and Geographical Survey of the Territories for 1874 (Colorado), by F. V. Hayden, Washington, 1876, and explorations made under direction of F. V. Hayden in 1876 (*Prof. F. V. Hayden*). Plan van een Onderzoekingsstocht in Midden-Sumatra, door J. Schouw Santvoort; Amsterdam, 1876 (*Het Aardrijkskundig Genootschap*). Dun Echt Observatory Publications, vol. i., 1876 (*Lord Lindsay*). Across Africa, by V. L. Cameron; 2 vols., 1877 (*Author*); and the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO MAP-ROOM FROM 8TH JANUARY TO 22ND JANUARY, 1877.—Submarine Telegraph map of the World, showing existing Telegraph Cables, December, 1876; by William Abbott; with a sheet of 'Analysis of the Submarine Telegraph Companies of the World, December, 1876' (*E. C. Rye, Esq.*). Newfoundland, by Alexander Murray, Esq., F.R.G.S. Two copies, one coloured geologically, the other showing the tracts fit for settlement and where pine exists (*Author*).

After the reading of the Minutes, Sir MORDAUNT WELLS said he wished to speak as to the correctness of the Minutes.

The PRESIDENT said if Sir Mordaunt Wells was going to speak to anything contained in the Minutes, the Meeting would be happy to hear him; otherwise he would be out of order.

Sir MORDAUNT WELLS said, with the greatest respect, it was not usual for

the President to anticipate any observations that a speaker was about to make ; and he was sure the greatest forbearance would be exercised towards him, when he said that since the last meeting he had received from all parts of England and Scotland an unparalleled number of letters, and did not on this occasion stand alone as merely representing his own opinions, but was now supported by a majority of the Fellows of the Society. At three o'clock that afternoon he had received from the Society what purported to be a Minute of their proceedings at the last meeting, and he wished to ask why the Minutes which had just been read differed from those which had been sent to him.\* There must be some object in sending to a humble individual like himself a Minute of the proceedings, an honour which had never been conferred on him before. In all probability, if he had not received the Minutes he would not have been present this evening ; but upon receiving them he felt it his duty, having taken action in the matter, to attend and again put a question with reference to the Minutes. Those who were acquainted with him knew full well that, having begun, he would never rest until the whole thing was investigated. He had received letters from officers of the highest distinction, and from scientific men, one and all complaining bitterly of the action of the officials. The course that had been pursued this evening had opened a door to him which could not be closed. The question must now be faced fairly ; and, in the presence of the Council, he put the question why the Minutes sent to him differed from those which had just been read ? Why should the Minutes have been sent to him more than to any other Fellow ? The 'Times' and other newspapers reported most faithfully the proceedings of the last meeting, and those reports brought forth the extraordinary correspondence which had taken place between him and the other Fellows. The patronage to which he had referred had been exercised to an amount unheard of in the history of the Society. He was sure the President would do him the justice to say that his demeanour, when he rose on the previous occasion, was most respectful, knowing as he did the distinguished position which the President held quite apart from this Society ; and it was in deference to that feeling, that he yielded to the decision of the Chair, even though the President himself afterwards entered into the question. If he had been discourteous enough, he might have taken advantage of that opportunity ; but he had too much respect for the President and for the Society. But now how did the matter stand ? The President represented a body of English gentlemen, in numbers and in point of education and standing unequalled by any Society in the kingdom, and it was these very gentlemen who complained of the action of the Council, and who, through him, said that on the occasion when the Arctic Expedition was discussed they were prevented from taking part in it, because the Hall was too crowded. The Arctic Expedition was mainly due to the action of this Society, yet the Fellows had never yet had an opportunity of discussing it. The arrangements were made altogether apart from the convenience of the Fellows. What must the outside world say when it was known that between 400 and 500 tickets were distributed independently of the Society ? Could the Fellows, as a body of Englishmen, be expected to allow such a state of things to pass unnoticed ? The tickets, too, were not given to illustrious men who were not members of the Society, but to those who carried opera-glasses, and, while Fellows of twenty years' standing were shut out, utter strangers, having no interest in geographical proceedings, were present to witness the parade that was then made. The character of the Royal Geographical Society was at stake. He was sure that no one could be more

\* This was merely a proof of Sir Mordaunt Wells' remarks at the former meeting, sent to him for correction for the 'Proceedings,' as required by the Regulations. The usual printed form accompanied the proof.—[ED.]

anxious than the President himself to have this matter sifted. He should therefore move that a Committee, consisting of not less than six Fellows of ten years' standing, should be appointed to investigate the whole matter in reference to the issue of those tickets; and that Committee would expect the officials to supply them with the history of the manner in which the tickets were distributed, and the orders that were received which ignored the Fellows of the Society. Unless that Committee was consented to, and unless the whole matter was thoroughly searched into, the great body of the Fellows would be greatly dissatisfied. He would do everything that was courteous and respectful towards the Council, and would frame his Resolution in any way that the Council thought most convenient for raising the question; but most probably he would be met with the ready concurrence of the Council. If it was so desired, he was quite willing that an equal number of the Council should act with the Committee, and that their proceedings should be presided over by the President of the Society.

The PRESIDENT said, he thought he had given sufficient evidence that there was no desire whatever, either on his own part or on the part of the Council, to prevent any fair discussion of any subject that was interesting to the Fellows generally. Of course, certain forms and rules must be observed, otherwise it would be impossible to carry on the business of the Society, and Sir Mordaunt Wells had relieved him of any difficulty in the matter by not attempting to put his Motion now, but simply giving notice that he would move it at the next meeting. To that course he had no objection, and he did not imagine that the Council had any either. They would make their arrangements accordingly, and put the Motion on the agenda, to come on in its due course. He perfectly recognised the courtesy with which Sir M. Wells had pressed what he might conceive would be a disagreeable and unacceptable subject on the attention of the President and the Council, but the Council had nothing to conceal, nothing that they did not desire to be freely discussed. They were quite ready to adopt any rule or regulation that the majority of the Fellows might think best in reference to those rare occasions when a particularly interesting question was to be discussed. All visitors might be excluded, or the Fellows might ballot for tickets of admission for friends, always, however, taking into consideration the fact that 4000 people could not be put into a space that would only hold 2000 or 1000. The Council were the administrators of the affairs of the Society for the Fellows, and if they did not act in accordance with the wishes of the majority of the Fellows, the Anniversary Meeting in May would afford an opportunity for electing other members of Council and another President.

Sir MORDAUNT WELLS said he was desirous of consulting the convenience of the Council, and would bring forward his Motion at any time that was considered most suitable. He was perfectly willing to let it stand over till the Anniversary Meeting, if the Council thought such course the most convenient. Probably, therefore, the President would direct one of the Secretaries to inform him (Sir M. Wells) what the wish of the Council was in this respect.

The PRESIDENT said he was quite ready to meet Sir M. Wells in the same spirit, and if Sir M. Wells would send his notice of motion to the Secretaries in writing, it would be laid before the Council for action to be taken upon it. It would be inconvenient to bring it forward at the next meeting, as it was hoped on that occasion General Strachey would deliver the first of the series of lectures that had been arranged on Physical Geography; but the Council would either allow Sir M. Wells to choose an evening, or they might fix the motion for the Anniversary Meeting, when the Fellows would have an opportunity of electing another President and another Council, if they thought fit.

Sir M. WELLS said not one of the gentlemen who had written to him, nor he himself, had desired any such change.

The following Paper was then read :—

*Recent Journeys in Madagascar*: by JOSEPH MULLENS, D.D.

[ABRIDGMENT.]

DURING the past two years, among the journeys undertaken by English missionaries in Madagascar, five have been of unusual importance. They have been taken over entirely new ground; their results tend both to increase and render more definite the knowledge recently obtained of the interior of Madagascar. The following is a brief outline of each of these journeys :—

### 1. IKONGO IN SOUTH-EAST MADAGASCAR.

The Betsileo Province forms the southern portion of the central plateau; and on its eastern side it is bounded by the Great Forest and the southern extension of the broad terrace of Ankay. The forest is in two lines, and the scenery it presents is some of the finest in Madagascar. When Radáma—about 1820—after much obstinate fighting, conquered the Betsileo tribes, and so extended the Hova dominion towards the south, a portion of the forest tribes successfully resisted him. The Tánálas submitted, and in the fortress town of Ambohimanga the Princess Ráovana now rules as governor in the name of the queen. South of these Tánála lives a hardy branch of the same tribe, the Ikongo, who hold possession of an immense isolated hill. During Radáma's wars they sustained one siege of eighteen months, and subsequently another of twelve months; and in each case resisted with success. The Hovas have never set foot on the Ikongo hill; the Ikongo have a deep dislike to them, and they maintain their liberty and their isolation with great tenacity to this day.

Naturally this isolation cuts them off from the improvement which is now rapidly raising the Betsileo as well as the Hova tribes. The Betsileo Mission has been established only eight years, and its members have been anxious to gain access to the Ikongo people. After sending and receiving friendly messengers, on October 1st, 1874, Mr. G. A. Shaw, the Superintendent of the Normal School in Fianárantsoa, having received a definite invitation from the king of Ikongo, set out to pay him a visit. Passing Imhásoabé, he reached Morókona on the eastern edge of the plateau and entered the Great Forest. Of this Mr. Shaw says.—“This is certainly the thickest forest I have been into in Madagascar, and is one continuous mass of trees from Morókona (which we left about nine o'clock) till we emerged at Aviávy at five. In it we met no one,

nor did we see a single house of any description, except just within the entrance at the south-east end of our route. I saw no animals but birds; though there were evident marks of great numbers of wild hogs, the turf having been torn up in many places by these animals in their search for grubs and roots. About half-way through this belt of forest a pair of mountains of strange shape rear their heads far above the surface of the plain. There is such a resemblance between the two that it would be difficult to distinguish one from the other. The northern side rises precipitously from the plain to the height of 1000 feet, the south and west sides are covered with thick brushwood. On the ridge between these two hills, over which we had to pass, we had a splendid view to the south-east. A deep valley lay before us, with the hills rising high on the opposite side, all densely covered with trees; and from near the summit of one of them a large stream came tumbling and roaring down into the valley."

After some caution and suspicion of Ratsiandraófana, the king of Ikongo, it was at length arranged that teachers should be sent to instruct his people. In June, 1865, Mr. Shaw took the teachers, and again visited the King and his people. Afterwards obtaining permission to travel by the southern road, so that he saw the whole Ikongo country. He says:—

"We slept at the entrance to the forest on Tuesday night. On Wednesday morning we found that, although the forest road was much shorter, it was very steep, and was almost one continual climb. On the top of one hill a break in the forest permits a view the most extensive, if not the most magnificent, I have ever seen. Being much higher than the fortress, this seemed at our feet; while for many, many miles the hills undulated away to the east, terminating in a white mist, which the guide said was the sea. He informed us that on clear days the shimmer of the sun upon the water made it easily distinguishable. At about noon we were once more among the brown grass of the table-land, and about ten miles from Ivohidroa, near which we stayed the night. The following night, long after dark, we arrived at home."

## 2. VISIT TO THE IBARA TRIBES.

The Ibára tribes were known to live on the south and south-west borders of the Betsileo Province. Occasionally Betsileo and Hovas have found their way among them during these recent years of peace; but they have done so in peril; and not seldom have individuals from among the Ibára paid visits to the southern

Betsileo towns. Mr. Pillans and I saw such men in the town of Ambóhimandróso, and we could not but be struck by their rude appearance, their uncouth speech, and the lumps into which their hair was rolled. The English missionaries have gradually got acquainted with them; and the tribes have learned about the Englishmen that they were kind, could give medicine to the sick, and were anxious to teach people and make them wise. Occasions were taken for sending messages and little presents to the Ibára chiefs; and at length invitations were received asking the missionaries to pay them a visit. When the ground was sufficiently prepared, Messrs. Shaw and Riordan, on April 27th last, commenced their journey, and left Ambóhimandróso at the south end of the Betsileo Province to enter the Ibára territory. Travelling westward they crossed the ridge which bounds on the west the great rice-plain, and also the valley of the Tsimandao, and came on the border of the Ibára country at Tsi-áfa-balála, a bold rock, 600 feet high, and nearly perpendicular on the south side. Next day they passed through the noble granite range, called Andringitra, of which Invárávana ("the gateway") and Kipaseha form conspicuous peaks; and were struck with the wonderful forms, the size and number, of the granite masses of which the ridge is composed. Apparently the range is like Ibety, the Váva Váto, and other masses of red granite, in the centre of the island. My colleague and I noted the serrated crest of this ridge during our visit; but it was too distant for close examination. Still going west and south through the well-watered valley of Isáhanámbo, they came to Bésikáona. They say of the country here:—

"Besikáona is situated at the entrance of an extensive and remarkably level tract of country, extending 30 or 40 miles south, and twice that distance east and west. This plain is somewhat higher than the plain of Tsi-énim-parihy, in which is situated Ambóhimandróso. It is crossed and re-crossed by a river, the Mènaráhaka, which rises to the east of the ridge east of Besikáona, and after traversing nearly the whole length of a valley in a western direction, turns south; then east to a point as far as its own sources." Mr. Shaw was told that the stream doubled on itself a second time: but Grandidier reports that near the foot of Ivohibe it cuts through the granite ridge, and becomes identified with the Mánanára. The point needs further inquiry. Going further west, through Ivily and Kivory, with their numerous cattle, Messrs. Shaw and Riordan came into the valley of the Central Ibára, with Ihósy as its chief town. They describe it thus:—

“Ihósy, a town of 220 houses, stands in the centre of an extensive valley, through which, from south to north, runs the River Ihosy, in its course to the Tsimandáo. This plain is enclosed with high hills, especially those on the west, where we noted two or three of considerable height. In several places the river spreads out into large lakes or marshes, partially covered with rushes and reeds, and forming the homes of large flocks of wild ducks and other wild fowl. As far as the eye can reach (a journey of a day and a half) north and south is an inhabited country containing about sixteen villages (towns they are called here), with from twelve to fifty houses. A king lives in one, Ipápanéna, to the south; and one at Ibetá-ninéna, to the north. Beyond this district to the south is a desert, uninhabited, between three and four days' journey in length. On the north is the same, for between one and two days' journey; and on the west over three days' journey; while on the east, though not strictly a wilderness, there are but very few inhabitants.

With a view to visit the Southern Ibára, our two travellers returned to the granite ridge of Andringitra, and near the north end of this ridge they seem to have found an extinct crater; in its hollow basin were four large and deep holes 14 feet across, with the bottom undistinguishable. Passing south, they came into the valley of the Ménaráhaka, which Mr. Shaw notices as a transverse valley, running across the island. From this point he went on to Ivohibe.

Ivohibe is one of the wonders of Southern Madagascar, and is well known to its scattered people. It is an enormous, isolated mountain, with a level top, standing in the centre of a broad plain, beyond and apparently below the Ménaráhaka Valley, and forming the next terrace toward the south. “In appearance and character it is like the fortress-rock of Ikongo, but its ascent is not so difficult. Like Ikongo, it has a lake of spring-water on its summit, which overflows and forms a considerable cascade on the northern side. This saved the native ruler and his people from defeat when they were besieged by the Hovas.

“In this plain I found the best population I have seen in the Ibara. The town I slept in, Ivòhimàrina, has fifty houses and a fair population. The town is the market for the Hovas, beyond which they are not allowed to pass without special permission of the king of Iantsàntsana, the tribe inhabiting this part of the country. There are six or eight other villages within half a day's journey, mostly on the banks of the river (the Ménaràhaka). The Ibara country extends nearly three days' journey farther south, but there is only a sparse population; it is called a desert, having

villages along the route at distances of about half a day's journey apart. The general appearance of the south country is flat, with a few isolated hills here and there; but the general level is about the same as that of the Betsileo.

"There was quite an excitement in the town when I arrived. Guns were fired, and the people came rushing out *en masse* to see the Englishman. Most of them had never been out of their own province, nor seen a white man. They stopped me at the gate to ask the usual questions about the health of Her Majesty, and they said that the town was mine; I could go and choose what house I liked, and take whatever I wanted. They found me a good house, and brought me and my bearers a plentiful supply of provisions, in the shape of an ox, a pig, fowls, rice, and manioc, together with firewood. Next morning the chiefs had assembled, and we informed them of the object of our coming."

### 3. SOUTH-EAST MADAGASCAR.

In June and July last, a visit was paid to South-East Madagascar by Messrs. Sibree and Street, who passed through the forest at a new point, and travelled over a great deal of new ground. Throughout the journey Mr. Sibree took careful observations, from which he has constructed a map of the route, and of the country along which he passed. This map has been embodied in the general map of Madagascar.

Messrs. Sibree and Street commenced the new portion of their journey at the south-east corner of the Betsileo Province, from the hill-town of Imáhazóny. In three hours they entered the forest, and travelled through it the entire day. They say:—

"Notwithstanding the danger of looking about, it was impossible to avoid admiring the luxuriance of the vegetation. Many of the trees were enormously high, and so buttressed round their trunks that they were of great girth at the ground. The tree-ferns seemed especially large, with an unusual number of fronds; and the creeper bamboo festooned the large trees with its delicate pinnate leaves. It soon became evident that we were descending, and that pretty rapidly. For a considerable distance we had a stream on our left hand, which roared and foamed over a succession of rapids, going to the south-east; and every now and then we caught glimpses of the opening in the wood made by the stream, presenting lovely bits of forest scenery in tropical luxuriance.

"At half-past four we emerged from the forest, and came down by a steep slippery path through bush and jungle. And now there opened before us one of the grandest scenes that can be imagined.



The principal valley, down which we had come, opened into a great hollow or bay, three or four miles across, and more than twice as long, running into the higher level of the country from which we had descended. The hills, or rather edges of the upper level, rise steeply all round this great bay, covered with wood to their summits, which are from 2000 to 3000 feet above the valley. Between these bold headlands we could count four or five waterfalls, two of them falling in a long ribbon of foam several hundred feet down perpendicular faces of rock. Between the opening points of this valley could be seen a comparatively level undulating country with patches of wood, and the windings of the river Mátitánana. On a green hill on the north side of the valley stood a group of houses, which we were glad to hear was Ivóhitrósa. This hill we found was 700 feet above the stream at its foot. The Tánála seem a very simple-hearted, kindly set of folks, and are most friendly. Our visitors were greatly interested in our watches, compasses, knives, pencils, &c., and quite entered into our wishes to get to know their words for various things. At this part of the island the high interior plateau seems to descend by one great step to the coast plains, rather than by two, as it does further north. The stream at the foot of this hill is only 500 or 600 feet above the sea; for we came down 2500 feet yesterday: and the two lines of forest which are crossed further north when going to the east have here united into one."

"*Saturday, June 17th.*—This morning we went down the hill on which the village is situated, crossed the stream, and ascended for some distance on the other side of the valley, in order to get a good view of the different gorges and their waterfalls. Mounting a spur of the main hills we had a good view of the chief fall up a deep valley to the south, and so opening into the main valley as not to be visible from Ivóhitrósa. This is certainly a magnificent fall of water. The valley is about a mile wide by two or three long; it ends in a semicircular wall of rock crowned by forest, and over this pours at one leap the River Mátitánana. Knowing the heights of some of the neighbouring hills, we judged that the fall could not be less than from 500 to 600 feet in depth. There is a large body of water, and from the foot rises a continual cloud of spray on either side, like smoke, with a roar which reverberates up the rocky sides of the valley. We were some three or four miles distant, but even from there it was a grand sight.

As they proceeded towards the coast, along the valley of the Mátitánana, they passed from the districts held by the Tánála, into those of the Taimóro tribes.

"The country all about here is delightful; there is a great deal of wood, but much open space; the hills are low and rounded in form; while behind us to the east is the lofty, deep blue, irregular outline of the higher plateau, with some prominent points towering above the rest. Among these, to the northward, a long hill was pointed out to us as the unconquered Ikongo.

"The direct distance from Ivohitrosa to the coast, as the crow flies, is not more than 45 miles. There is but one great step downwards from the upper interior plateau, and not two, as is the case further north. From 3000 feet high above the sea, a descent is rapidly made to between 600 and 700 feet; and then there is a long extent of undulating country, with low hills and patches of wood extending for 30 to 40 miles to the sea. The hills gradually decrease in height and the forest becomes thinner, until for the last few miles there is an almost bare and dead level."

At the Hova Fort of Ambóhipéno they stayed a few days, and Mr. Sibree took the opportunity to get bearings of the neighbouring villages. In the far distance to the west rose the long and lofty line of the interior plateau; but at no great distance from where we descended from it, it sinks abruptly to the plains; confirming Grandidier's statement that at about the latitude of  $23^{\circ}$  s. the elevated interior country ceases, and that from thence to the sea southward are low alluvial plains. There is, however, one break; at a few miles' distance from the termination of the plateau, there is a lofty detached mountain, Ivôhibé, which must be a magnificent object when seen from only a few miles' distance, as it is nearly as high as the elevated table-land. From thence there are only a few unimportant hills to break the level line which stretches out of sight far to the southward. On my way to and from the observing ground we passed great numbers and many varieties of butterflies in a few minutes' ride through the narrow lanes. Judging from this specimen, an entomologist would find a rich harvest in the Taimóro country.

"In the evening, when talking with the people, we were surprised to find that we were in one of the villages where the Arab influence is said to have been very strong in former times. The people here at Ivátomásina are called Zafin' Ibrahima (descendants of Abraham); and they say they are 'Jiosy mihitsy' (altogether Jews), and have many customs derived from the Jews. But what these were we could not ascertain; and there is certainly nothing in the appearance of the people, either in colour or features, to distinguish them from the majority of Malagasy. There is no doubt, however, that the Arabs have at some former time had a

settlement here and on some other parts of this south-east coast, and to some small extent taught the use of Arabic letters. This probably gave rise to the statement in some old works on Madagascar that Malagasy was a dialect of Arabic. An intelligent young man, who came with the chief from Iváto, gave me a paper with all the Arabic characters and many of the syllabic sounds, with their equivalents in Malagasy. He also showed us a paper written by M. Grandidier in 1870, and given to him as a certificate that the bearer had copied for him various extracts from native Arabic books of prayers, genealogies, and sorcery; and that he (M. Grandidier) was well satisfied with his zeal and accuracy. We inquired about these books, but there seemed a good deal of unwillingness to let us know anything about them, or see them. The books of sorcery they said were burnt at the time of the burning of the idols in 1869."

From Ambóhipéno the party journeyed south with the view of visiting the Hova forts of Máhamánina, Ankárana, and Vangain-dráno. "After passing (they say) through a narrow belt of wood, we came up to a ridge rising nearly 500 feet above the sea-level, a considerable height for this flat region. From this there was an extensive view; and on a prominent hill nearly due west was a conspicuous point, which the glass showed plainly to be a lofty steep-roofed *lapa*, with a good number of houses clustered round it. This was the Hova fort of Máhamánina, then about 12 or 14 miles distant. The town is wrongly placed on Grandidier's sketch-map of Madagascar; he shows it as about 40 miles nearly due south of Ambóhipéno, whereas it is really about 25 miles south-west by west. But as we heard he did not go further south than Ambóhipéno on this part of the coast, his information was probably derived from the natives, and was consequently vague and unreliable."

At Mahamánina (they say):—"From our house we have a pleasant and extensive prospect over a large extent of comparatively level country. We are now on the same parallel of latitude as Ivóhibé, the very lofty detached mountain to the south of the interior plateau. South of this, a very low line of somewhat higher land or hills than the general level of the Taimóro country seems to run for a considerable way to the south. To the south-west, at perhaps 20 miles distant, is a ridge of no great elevation, stretching north and south for a few miles; but beyond this nothing appears to break the low level line of the plain. The country to the west of Máhamánina is nearly bare of wood, but the main line of forest seems to run along the low country southward in the same general line that it follows

on the edge of the upper plateau. Tribes of Tánála inhabit this forest region and its borders, as they do for 200 miles to the north of this, and there seems a considerable population of Taimóro to this place; I noted the bearings of at least twenty villages west of Máhamánina. The great mountain of Ivóhibé is about five days' journey from here, and around it are two tribes of Tánála, called Taivónona and Tai-ònja; of these a chief called Raibáhy, of a family named Záfimanèlo, is king. The Hovas give a bad account of these Tánála, but the Taimóro told us there would be no difficulty in going amongst them. The tribe inhabiting this neighbourhood is called Záfisòlo.

"We ascertained that it was only a week's journey from Vangaindráno to Fort Dauphin; that there were villages and a large population all along the route; and that the Taisàka and Tanòsy tribes were friendly and acknowledged the Hova authority. Some, if not all of the people here, are a Sàkalàva colony from the west of the island, and are called Mäsotáfika. For *eny* they say *eiky*; for *ity*, *itòky*; for *iry*, *iròky*, &c.

Having reached Vangaindráno, they observe:—"We were surprised at the large number of villages to be seen in every direction in this neighbourhood; they stand in groups of from two to half-a-dozen in a line and close together. It would be an interesting excursion to take a canoe and ascend the stream as far as it is navigable, which is for several days' journey, and so get into the interior of the southern portion of Madagascar, a district as yet perfectly unknown to Europeans, and probably to the Hovas as well. Except the Mangóro, the Mánanára is the largest river on the east coast, and rises far in the interior beyond the line of forest.\* From all accounts there is a large population as one goes further west. Both to the south and north of Vangaindráno, the people seem to be divided into tribes who live on the banks of the different rivers, and who in many cases are called after the names of these rivers; while there is a tract of uninhabited land half-way between each considerable stream."

Throughout their journey, and on their return, they speak repeatedly of the kindness and hospitality with which they were welcomed by their native friends.

"In descending the hill I noticed that the villages in the neighbourhood of Ankárana were not so numerous as those surrounding the other three Hova forts in this part of the country: and the reason of this seemed plain: Ambóhipéno, Máhamánina,

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\* Its upper portion is the *Ménaràhaka*.

and Vangaindáno are situated in the valleys of considerable rivers, while Ankárana has evidently been selected on account of its strong situation, commanding a view of an extensive tract of country. Over a low range of hills to the west two prominent rounded mountains are seen; one of these, Isaonjo, it is said, occupied old Ràiningòry more than nine months in attempting to take it. He did not effect this, but eventually succeeded in setting fire to the town on its summit. On the top and slopes of Ankárana are large masses of volcanic rock."

At several points, on both the outward and the return journeys, Messrs. Sibree and Street observed masses of trap-rock, scoria, lava-streams, and the like; and it is evident that the volcanic eruptions so patent in the north and centre of the island have not been wanting in its southern districts.

"In three small ravines running down to the shore there were old lava-streams, some cut through by the action of water, and stretching out into the sea. Passing a village called Lôharàno, we presently came to an extensive lagoon, extending northward for four or five miles, and formed by the River Itampòlo, before it reaches the sea. This appeared to be the first (from the south) of that remarkable series of lagoons bordering the shore, and extending, with but few breaks, as far north as Hivòndrona, near Tamatave, a distance of 260 miles. Along the southern side of this lagoon are masses of lava-rock, some of it in enormous blocks."

Journeying along the sea-coast, at length they reached the Mananjára River, nearly a mile wide. "We got canoes and crossed at the bar; and so, after dark, reached Másindràno, on the northern bank of the river, and close to the sea. There is no town called Mananjára, but this Másindràno is the *ladóana* or port; while half a day's journey up the river is Itsiatósika, the Hova fort, with a governor. This is the largest town we had seen since leaving Fianaràntsóa. It has an air of neatness not very common in this country, and there are numbers of well-built houses standing in spacious court-yards. These belong mostly to French traders, of whom there are no fewer than forty residing here. A little way into the town we were met by the Commandant, with his officers, and the pastor, who gave us a kind welcome, and led us to a good-sized house."

From this point they ascended the river in canoes to Itsiatósika and beyond it; and passing Ambóditránambo, and climbing the forest-covered walls, by Andákana and the Valley of the Mananjára, they at length reached Ambohimánga, the capital of the Northern Tánála, where they spent two days.

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"These Northern Tánála, who acknowledged Ióvana as their chief, number about 6000, and extend from here to about three days' journey northwards. The situation of this town strikes one as exceedingly pleasant. A couple of hundred feet below, to the east and north, flows the River Mánandriana, and the surrounding hills on the further side of this stream are about the same height as the town, and are mostly covered with bamboo. Three or four miles to the west there seems to be a wide valley with bush and dwarf vegetation; but beyond this is a bold, prominent ridge, running nearly north and south, and dark with forest; while beyond, to the south-west, are lofty granite peaks in the far distance, at the edge of the table-land. Ambóhimánga is more than 2000 feet above the sea-level."

From this pleasant resting-place, the journey to the capital was easy. After a long climb from Ambódivóahangy, at the foot of a lofty hill, they reached Ivohitrámbo, 4750 feet above the sea, on the edge of the inner forest and plateau, and commanding a magnificent view on every side. Thence a few hours' run brought them to Isárandráhy, on the high road between Antanánarivo and Fianárantsoa.

#### 4. JOURNEY TO THE WESTERN SAKALAVAS.

Few parts of Madagascar are so little known as the western districts. All the east side of the island is under Hova dominion, and, being well supplied with rain, is covered with forests. At many ports on the coast French and English traders reside, and there is constant intercourse with the interior. Not so with the west. Here report has long spoken of a broad belt of no-man's-land, with hostile Sakalava tribes on the farther side. This unknown region has now been pierced by English travellers; the veil has been lifted, and we know what the land contains. A few paragraphs will suffice to exhibit the result.

A journey to the west was undertaken by Messrs. Sewell and Pickersgill, in June, 1875, being commenced from Máhatsinjo, four days' distance from Antanánarivo, and on the edge of the volcanic region near Lake Itázy. They say:

"We had travelled but a few hours west of Máhatsinjo before we lost all trace of human habitations, except here and there a few huts close to large cattle-folds, and a little further still, two military stations not far from each other. About a day's journey from Máhatsinjo we crossed the River Sakáy, which is about 100 yards broad, and though shallow when we crossed it, must contain a large

body of water in the rainy season. This river may be regarded as the extreme western limit of Imerina; and between it and the Sakaláva lies an extensive tract of waste land, about six days' journey across. The greater part of this waste is covered with long grass, and cannot be much unlike the prairies of North America. Often the long grass on each side of the path grew quite over it, so that nothing of it was seen except the part on which we were treading, and often, too, the grass was quite above our heads when walking. Making way through this grass was very trying to the feet of our bearers, and a good deal delayed their progress.

"About two days' journey from Máhatsinjo we reached Tánimádry, a small military station on the banks of the Imánga. We had stayed to dine at another still smaller station, Tsinjoarívo, two hours before. Both these places, but especially Tsinjoarívo, made us feel very much for the poor people who were condemned to live there. They were immense cattle-pens, with a few houses connected with them; and the whole were surrounded by a thick fence of prickly pear.

"Antsirámamandily took us by surprise; it is a large town for Madagascar, having from 150 to 200 houses in it. It is thoroughly isolated in the midst of the waste; but it is a stopping-place for almost all who travel between Imerina and those parts in the west which are subject to the Hova."

Starting from this point with provisions for four days, they say:

"At noon we reached another military station, Márovátana, as wretched as any we had seen. The houses there were the last we saw till, three days afterwards, we looked upon the plain in which Ankavándra is situated. In some parts of the extensive waste through which we travelled there are great numbers of wild cattle, and every dry season many of the natives (both Hóva and Sakaláva) are engaged in catching and taming them. On our return journey we met a party of about 200 men thus occupied. They came from the western part of our district, and it was interesting to be recognised by them as one who had preached in a village from which many of them came. On a few occasions we met with these wild cattle, but not often. Two or three times also we met with guinea-fowl, which started before us like partridges. The road all the way from Mahatsinjo had presented few objects of interest. The last morning's travel was somewhat exciting, as we drew near to the western limit of our journey and saw glimpses now and then of the broad plain in which Ankavándra lies. The descent into

this plain was very steep. The table-land on which we had been walking for several hours appeared by our aneroids to be on an average about 2500 feet above the level of the sea; but after we had descended the hill and come to the stream at its foot, they pointed to only 400 feet above the sea-level.

"The River Mánambólo that flows past the town is a really fine river, and as we might suppose from the low level of the plain, there is but one slight impediment to the passage of boats up the river from the sea to Ankavándra. This impediment is about a day's journey to the west of Ankavándra, where the river finds its exit from the plain through the high hills on the western side of it. The proper name of Ankavándra is Miádanarivo, Ankavándra being the name of a river which runs close to it, and from which its supply of water is obtained. The town contains probably as large a Hova population as Antsiróamandidy, with perhaps an equal number of Sákaláva living in its immediate vicinity.

"We set off to Andránonandriana (another military station a short day's journey north of Ankavándra) on Saturday morning. Shortly after leaving the town we crossed the Mánambólo. It was at least 150 yards across, and there was another 100 yards of sand which is covered in the rainy season. The journey was a delightful one. The road was tolerably level, leading us often through park-like scenery very similar to parts of the road between Tamatave and Andovoranto. The grass, however, had none of the freshness of that in the east of Madagascar. The country here, and I imagine all west of the hilly country of Mándridráno and Vákinankáratra, seems to be quite free from the drizzly rains so common in the east during the winter, and this has a great effect on the character of the vegetation. The little streams coming down from the high land to the east were all skirted with trees, of which a great number were oleanders, and a still greater number were various kinds of acacias. The tamarind-trees, however, attracted my attention more than any others by their rich foliage, their beautiful form, and the grateful shade they furnished. I measured one that covered a circle of about 30 yards in diameter, and there were many whose branches extended over a space of 20 yards in width.

"On Wednesday morning we left Ankavándra and commenced our journey south to Imánandáza. The country during the first day's journey was very similar to that on the road to Andránonandriana, except perhaps that we saw more Sákaláva villages. But the second and third days and the first part of the fourth were more wearisome, both to us and our men, than any other portion of our journey from first to last. I should suppose that the plain of



Ankavándra is about 20 miles across, but there runs along the middle of it a range of very low hills, which seem mostly comprised of sand, with large numbers of quartz and other pebbles rounded by the action of water, and the whole thinly covered with short grass. What had been the previous state of this wide plain, and under what circumstances the water had acted upon these pebbles (we could not see the slightest trace of shells or former animal life) we often tried to imagine, but could come to no conclusions; but the effect of the pebbles on the feet of our men was unmistakable, and two weary days we spent in getting over them. Not that the whole journey was a wilderness. We crossed a large river, the Itondy, which forms a very important branch of the Mánambólo, and this was surrounded by luxuriant vegetation; and at the close of the second day's journey from Ankavándra, just as the sun was setting and whilst still near this river, we were for a while quite at a loss to know how we were to get through the tall prickly reeds, which, with a small but deep stream of water, seemed effectually to stop our progress."

After another weary journey over the stony plain, and continued struggle with the reeds and nettles, they reached Imánandáza. The river they found 150 feet lower than the Mánambólo at Ankavándra; but the town is on a low hill, and on the same level as the latter.

"On Monday we ascended a hill to the south of the town, that we might be able to see the large river which runs to the west about a day's journey to the south. All the rivers from the Sakáy, a long way to the north of Itasy, to the Manía, a large river which flows through the country of the Betsileo, unite in one great river about 30 miles to the south-west of Imánandáza. After the junction of the Sakáy with the Kitsámby there is a very fine waterfall or remarkable rapids, almost due south of Imánandáza. We had a great desire to go and see the falls, but it would have kept us at least three days longer on our journey. The river there is called Tsiáfadréharéha, and these rapids must always present insuperable obstacles to the navigation of the river further into the interior; but from that point to the coast, probably about 80 miles, there seems to be no impediment. All the natives who spoke of this river seemed to think that there was none other like it for width and depth in Madagascar. From the waterfall to its junction with the Manía it is called the Mahajilo, after that it is the Tsiribihina (the river that cannot be forded). At the mouth of the river is the large town of Tsimánandrafózana, where a French trader, who goes among the natives by the name of

Samanta, has established himself. Judging by the reports of the natives, and by his being known in all the country round, he must be carrying on a large trade. Many Arabs also live there, and Mahometans from the islands north of Madagascar. We met one of these, who had come up the river in a canoe as far as he could on the way to Imánandáza, and was going about among the Sákaláva selling his goods. He assured us that no slaves were brought to Tsimánandrafózana.

From this point a long and wearisome journey of four days, through troublesome grass and under a hot sun, brought them again to the Mandridráno, from whence they had set out.

##### 5. THROUGH THE ANATIVOLO TO SIHANAKA WEST.

A fifth journey was undertaken in June last, in an entirely different direction, by Messrs. Moss and Lord. These gentlemen proceeded to the northward, to a point not hitherto visited by Englishmen; and then, turning east, entered the Sihanaka Province on its west side. They also passed over much new ground, and have added valuable contributions to our previous knowledge of Northern Madagascar.

They first visited the Anátivolo, which was carefully mapped by the Rev. J. Sibree two years ago; and rested at Anósibré, at which town the Governor resides. The people of the district are known as Olo-máinty (black people); they resemble the Sihanaka tribes, and their tradition is that their forefathers were brought hither, during his wars, by Impóinimérina, some ninety years ago. The Anátivolo marks the first great fall in the ground on the north side of the central plateau. "The high ground which forms its southern boundary is, in fact, the northern termination of the great Imerina plateau, which, farther north-east, ends at Ambàravàram-bàto, and east at Angàvo. The Anátivolo plain, shut in east, west, and south by lofty hills, extends northward, with alternations of low and rising ground, at a mean elevation of from 3000 to 2300 feet above the sea, as far as Ambòdiamòntana, five days' journey away. Along the whole extent of this large district, the soil is of sandy alluvium and red porous clay, easily disintegrated by the action of wind and rain. In many places on our journey we saw whole hill-sides that had been eaten and washed away by the tropical torrents, forming precipices of sometimes 1000 feet in depth, and chasms in whose shelter luxuriant forest-trees find a congenial habitat, and in which frequently large herds of cattle are fenced off and protected from the winter-cold. The tending of cattle on a somewhat larger scale, and the cultivation of rice,

sugar-cane, and mángházo (manioc), on a somewhat small scale, form the chief occupations of the people."

Passing over the rough clay hills to Andràopásika, crossing the Mánanara River, close to a conspicuous wooded hill called Vohiléna; and resting at the stations of Andránomiántra and Tsárahá-fatra, which Grandidier has placed on his map, they encamped at the foot of one of the great hills of the northern districts, the hill of Vóambóhita. Mr. Moss says: "Its magnificent, black, basaltic mass had been visible for several days, and now towered grandly some 2000 feet above the plain. Arrived at its foot, we had a good view of this noble mountain. Its northern front appeared to extend about four miles, presenting a bluff precipitous face of black basaltic rock. It rises about 2000 feet from the valley, and its summit can scarcely be less than 4500 feet above the sea. Its general appearance resembles Table Mountain at the Cape of Good Hope. For three days at least, on our further northern journey, it was still the most conspicuous landmark, and we afterwards kept it in view for several days longer on our eastward course to Ampàrafaravòla and Ambàtondrazàka."

At Móraféno, a few miles beyond Vóambóhita, they encamped on the banks of the Bètsibóka, here become a considerable river. Passing Ambódiámóntana, one of Grandidier's stations, they ascended an isolated moor, some 4500 feet above the sea, and the next day reached the important Hova fort and garrison of Antòngodrahòja.

"Antòngodrahòja is 'beautiful for situation.' It stands on the very verge of the high table-land over which we had been travelling for the last two days. About 4150 feet above the sea, it commands a most magnificent view of the broad valley of the Ikiòpa, the Bètsibóka, the Amparihibi, and the Mähajamba on the north, as far as Trabònjy. From Antòngodrahòja the ground descends by a precipitous path some 2000 or more feet to the plain below; after which a good road leads by easy stages, three days' journey to Trabònjy, and thence to Mòjangà." Close to it, on the east, is the peak of Námakia, under which the pass into the plain runs. From its position on the old high road to Mòjangà, and at the edge of the central plateau, it is a place of considerable importance. Its people are unusually intelligent, and far more advanced than the occupants of other towns on the route. And the rustling of silk dresses, and the display of French hats in the little settlement church, were associated with a fair knowledge of the latest hymns, and a most hospitable and kindly welcome to the friends who had come to instruct them."

In passing from Antòngodrahòja to the Sihánaka country, the

travellers retraced their steps to Tánifótsy, and then went eastward. And it is a fact to be noted, that on the road they kept ascending and then descending, crossing hollows and ridges alternately, showing that they were on the northern edge of the plateau, and that the sandy clay had been washed out from between the rocky ridges on which it rests. The population on the route they found to be Sihánaka, proving that this empty district had received its small supply, not from the centre of the island, but from the coast. Their ignorance was lamentable in the extreme. In the village of Antsámpandráno, the little population of 200 people, including several soldiers, were terrified at the sight of two live Englishmen, and at once ran away.

At Amparafávola they rested with the fine old Governor, an excellent man in every way, and then prepared to cross the Alàotra Lake. Between 8 and 9 p.m., they landed at Antànibáo.

Other journeys have been undertaken within the province of Imérina by Mr. W. Johnson; and a large amount of new detail has been gathered by him for rendering the map of the province more exact. Mr. Johnson has visited and examined the great hill of Ambohimiangára; the north and west sides of Lake Itasy; and the valleys of Ankáratra. He also succeeded in ascending four of the principal peaks of Ankáratra, the highest of which he judged to be 8763 feet above the sea. The extreme care with which Mr. Johnson observed, imparts to his suggestions and corrections a special value.

#### CONCLUSIONS.

The conclusions to which the facts gathered on these several journeys point may be thus briefly summed up:—

1. Since much new ground has been visited, considerable additions have been made to our knowledge of the geography of Madagascar. At several points the area of exact knowledge has been extended with correctness and care. Where vast chains of hills once met the eye, or a broad barren desert stretched out before us, and we could only long for new opportunities of finding what lay beyond,—now the ridges have been crossed, and the country behind explored; the desert has been passed, and the low country beyond has been duly surveyed. In this way the Ibára country, the Sakaláva districts on the west, and the Hova territory on the south-east, have been described. The forest has been crossed; important points, like Ivóhibé, the valleys of the Matitánana, Mananjara, and Mánanára, the course of the Mania, Vohambóhitra, and the Anátivólo, have been successfully determined. A new edition of the Madagascar Map has become necessary.

2. We know with greater exactness the boundary-line of the great upheaval, which has given us a raised plateau in the centre of the island with a basis of primitive rock, and a coast platform surrounding it on almost all sides. The gneiss ridge of Bónjo Lava, which marks very decidedly the western edge of the plateau, is more clearly known. The point where the two granite walls, which uphold the terraces on the east side of the island, coalesce and become one, is better defined. The northern lip of the same formation, with its high moor, has also been again visited.

3. The broad terrace of red sandy clay which surrounds the granite centre on all sides, and forms an outer terrace, about 800 feet lower than the central plateau, has been more fully examined, and its unfertile character been better understood. Here, too, as on the upper plateau, the effects of denudation, especially by the ordinary agents of rain, storms, streams, floods, and waterspouts, may be seen on an enormous scale. It is to be noticed also that, as the granite walls on the east are lofty and little broken, except along the terrace of Ankáy, this denudation has been thrown to the west and north, where the Betsibóka and Ikópa river (on the north and north-west), and the Mania, Tsiribihina, and Mánjóky (on the west), gather into themselves streams of water, which rise even on the very edge of the eastern granite itself. One thing of interest remains to be examined. No traveller has yet visited those localities in which these important rivers leap over the outer edge of the granite core of the island on to the lowest terrace which extends to the sea-shore.

4. The volcanic eruptions which were known to have been widespread, are now seen to have spread more widely still: and their results are traceable on the south-east coast, in the Ibára country and in Voambóhitra. Few countries in the world, of so limited an area as Madagascar, bear witness to volcanic action so enormous as this.

No addition has recently been made to our knowledge of the secondary formations in the district around the coast.

5. In all the districts examined, the estimate previously formed of the population has had to be seriously reduced. Whether among the Tánála, the Ibára, or the Sakalávas, the population has been found to be very thin; vast areas of territory are seen to be almost empty. But another thing has also been witnessed. There is in all directions an earnest desire for improvement. Wherever the English teacher goes, his visit is welcomed; his words of counsel infuse new life; his books are purchased; his assistant teachers are asked for. Little progress has been made in regard to roads,

and the conveniences of civilisation are not eagerly sought after. Time is wanted for right ideas to blossom and bring forth fruit. But the vision of the future is bright: its interpretation is sure.

[The Paper will be published entire in the 'Journal,' vol. xlvii.]

The Rev. J. PILLANS said all the movements of civilisation and progress in Madagascar had spread from the centre, and the value of what was taking place in the island would depend very much on what was going on in Antananarivo, the capital city, which had a population of about 80,000. That city was to Madagascar even more than what Paris was to France. All kinds of movements began there and spread throughout the country. The great centre of life at present was in the mountains, the capital being situated on a hill 4500 feet high, surrounded by a plain at a level of 4000 feet. It had been supposed by some persons that as civilisation progressed the centre of life might change, and come down to the great plains and seaports. He was glad to be able to say that education, with which the great modern movement in Madagascar began, continued to spread wherever the Hovas' influence was felt. Year by year this work of education was being helped forward, and on the whole the people were receiving the efforts of the Government and the missionaries very kindly. It was only natural that they should do so, for the inhabitants of the remote districts, such as those which had been described in the Paper, had heard of what had taken place in the capital, and, apart from any appreciation of any great and high results from it of an intellectual and moral character, they saw that it had an elevating effect socially and industrially. Wherever teachers went they found that, partly from curiosity and partly from higher motives, the people were ready to welcome them; and it would seem that the Hova Government were now in a fair way of knitting the whole island into one strong people; there were, however, many obstacles in the way of rapid growth. As far as circumstances permitted, the Hovas and the Betsileo people were industrious, and worked hard in their rice-fields; but a great many things prevented the growth of their industry. There were no roads through the island, and even in the capital itself the roads were of the rudest description. There was thus no means of transporting their produce from one district to another. Besides this, there were no beasts of burden except a few scores of Mauritius ponies and a few bullocks and donkeys. The ponies only carried a few of the higher classes. There was thus no opportunity for the development of industry. If there were, the people would very soon show great progress, for they were keen traders and had a passion for money-getting. Up to the present time the Government had been afraid that outsiders were very eager to get possession of the country, and they had refrained from making roads so that any army coming from the coast might find transport very difficult; it was even said that, formerly, there was an easier route to the east coast than that in use now. When suggestions on this matter were made to some connected with the Government, their reply was, "We are too much occupied with house-building just now; we cannot begin road-making till it is finished." In 1873-4 the capital was being almost rebuilt. The old houses were of three kinds; rush houses, mud houses, and wooden houses. These were being replaced by houses of a very superior style. The system of labour, too, was opposed to any very rapid advance in the industrial development of the country. In 1817 the slave-trade was legally put an end to; but in the dark days of persecution the treaty was set aside, and it was not till 1865 that the slave-trade was again made illegal. Slavery, however, still prevailed, and it was a common thing to see twenty or thirty slaves for sale in

the market. As a rule, they were kindly treated; but the system prevented the growth of industry. When he was at the capital, the woman who kept his house was a slave. One day she came to him in great trouble. It was a usual thing for the slaves to hire themselves out, and give half their wages to their masters; but in this case the master had sent to say he must have more than half the wages, because the Court having adopted European dress, he found the change very expensive. Year by year, as the slaves became better educated, their condition became worse. Very lately there was quite a blaze of feeling throughout the country, a rumour having spread that Queen Victoria was about to land in Madagascar with a British army, to set all the slaves free. But even if the slaves were set free one by one, they would be liable to public service, and the life of a soldier was as hard as that of a slave. In one or two ways the people might be helped by foreigners. The country was not particularly rich either in its fauna or its flora. Their chief culture was rice, but they were in want of crops that would grow in the upper parts of the country. Then, they had no sheep. They had a species of sheep with short hair instead of wool, but if they could get sheep, whose wool would supply them with clothing, it would be a great boon to the people in the cold highlands. He did not think that the country itself was very tempting to capitalists, and the Government were rather jealous of such people.

Sir BARTLE FRERE said he had only seen Madagascar at two or three points on the north-west coast, chiefly at Mojunga and Nossibé; but all present would agree that very few subjects of greater interest had been presented to the Geographical Society than that to which they had just listened, regarding the great changes which had been wrought in Madagascar since it was first opened to Europeans by the exertions of the missionary Ellis and his brethren and successors. In the days of Marco Polo, Madagascar occupied a very large part of the attention of travellers in the East. From what was stated by Colonel Yule in his excellent notes to 'Marco Polo,' it was clear that the Arabs of those days had a great deal of intercourse with the coast of Madagascar; and he believed Dr. Mullens was of opinion that there was some foundation for the tradition that that Arab intercourse had existed from the days of the early Phœnician traders. Such tales as those of the enormous roc, whose feathers were 30 feet long, had their origin in the stories brought home by Arab travellers from the Madagascar coast. Why this intercourse was interrupted so completely was one of the curious problems of history, which, no doubt, some of Dr. Mullens' friends would in time elucidate. Apparently from the date of the commencement of European domination in the neighbouring seas, Madagascar declined in civilisation; but when, about the beginning of the present century, interest was again attracted to the country by a Scotch gentleman, who first induced the missionaries to go there, a slow awakening again commenced, and of late years it had been accelerated in a most extraordinary manner. When it was remembered that a written European character had been given to the language, that books had been printed in the native language, that the country had been opened up to missionaries, that the governing classes had been brought over to the side of Christianity, and that European travellers could now safely pass through all parts of the island, it must be acknowledged that a tolerably good piece of work had been done in one generation. Indian traders had again begun to resort to the coasts. At Mojunga he found as many as forty houses belonging to Mohammedan traders of Indian origin, and having their head-quarters in India. In this way the country was being penetrated in every direction, and it offered one of the most tempting fields for discovery that were now open. Naturalists would there be rewarded by finding the remains of animals now extinct, and the flora was also very interesting. A great part of the island

was still a blank as far as the map was concerned, and discoveries might possibly yet be made as great as those which had rewarded the exertions of the missionary travellers. He hoped that, among other channels for doing good, the missionaries would not forget to prosecute geographical investigations, in which they had already so successfully laboured.

THE PRESIDENT, in conclusion, said the Paper had deeply interested him, as showing how geographical exploration led by a natural and simple process to the introduction of Christianity and civilisation. That was the legitimate course of things, and it was most gratifying to hear how kindly and well disposed the natives were. They even exceeded the old Castilian Hidalgo's hospitality, when the whole house was placed at the disposal of a visitor, for in Madagascar the natives said to strangers, "The whole town is yours," and they provided everything that was required. He should be very sorry to think that the old influences that used to prevail in Madagascar would ever turn the kindly blood of these people into the viciousness that had been developed elsewhere. Certainly the progress made in the present generation was most encouraging and gratifying. The desire of the people for improvement was one of the most hopeful symptoms. No doubt it was rather unpleasant walking into a village with thirty leeches adhering to the foot; but, after all, the village itself appeared to be a pleasant place, and visitors had a pleasant reception. The Paper showed how much might be done when a right course was adopted, and when there was a continuous effort to carry the beneficial influences of civilisation, apart from its vices, into the midst of a simple and comparatively uncivilised people. There was no more encouraging example, in the whole course of missionary enterprise, than that presented in Madagascar, since, in 1816, Sir Robert Falconer, the then Governor of Mauritius, first attracted the attention of England to the island as a promising field for missionary exertion.

*Sixth Meeting, 12th February, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*J. P. Joaquim, Esq.*

ELECTIONS.— — *Boyd, Esq. M.D.; E. A. Brown, Esq.; Rev. G. Brown; Charles Napoléon de Cardi, Esq.; John F. Corscaden, Esq.; Jno. Findlay, Esq.; Richard Frewen, Esq.; Walter Green, Esq.; Albert Grey, Esq., B.A.; Henry C. Roberts, Esq.; E. P. Vacher, Esq.*

DONATIONS TO THE LIBRARY, FROM 22ND JANUARY TO 12TH FEBRUARY, 1877.—Reports to the Kaitakushi by Horace Capron. Tokei, 1875 (*Colonisation Department, Japan, per H.M. Sec. of State for Foreign Affairs*). Palestine Exploration Fund, Quarterly Statement, Jan. 1877 (*The Society*). La Suisse à l'Exposition de Géographie de Paris, par H. de Saussure; Genève, 1876 (*Author*). Serpent and Siva Worship, by Hyde Clarke, 1876 (*Author*). Analytical Report upon Indian Dialects spoken in Southern Cali-



fornia, &c., by A. S. Gatschet; Washington, 1876 (*Author*). On Russian Proverbs, by J. Long, 1876 (*Author*). Gazetteer of the Central Provinces of India, 2nd edn., by C. Grant, Nagpur, 1870, and Eastern Persia, an account of the Journeys of the Persian Boundary Commission, 2 vols., 1876 (*H.M. Secretary of State for India*). Die Pflanzenwelt Norwegens (Specieller Theil), von F. C. Schübeler; Christiania, 1875; Windrosen des südlichen Norwegens, von C. de Seue, Kristiania, 1876; and Études sur les mouvements de l'Atmosphère (Pt. 1), par C. M. Guldberg et H. Mohn, Christiania, 1876 (*The Royal Norwegian University*). Norske Turistforenings Arbog for 1874 and 1875, and Reisekaart over Norges 5 Sydlige Stifter, Kristiania, 1873 (*The Norwegian Tourists' Club*). Aarbøger for Nordisk Oldkyndighed og Historie for 1875 and Hefte 1 and 2 of 1876, and Tillæg til Aarbøger, 1874 (*The Northern Antiquarian Society*). Trading Life in Western and Central Africa, by J. Whitford; Liverpool, 1877 (*Author*). Notices of Principal Manufactures of the West of Scotland, Catalogue of Western Scottish Fossils, and Notes on the Fauna and Flora of the West of Scotland, 3 vols., Glasgow, 1876 (*The Glasgow Local Committee of the British Association*). Geography, by G. Grove, 1877 (*Author*). Essay on New South Wales, by G. H. Reid, Sydney, 1876 (*The New South Wales Government, per Messrs. Trübner*). And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM 22ND JANUARY TO 12TH FEBRUARY, 1877.—Eighteen sheets of Tracings of the Nile from Ripon Falls to Khartum, including the Albert Nyanza, and between Khartum and Berber, on various scales (*Col. Gordon-Pasha*). Fifty-one sheets of the various Government Surveys of India (*H.M. Secretary of State for India*). Map illustrating Commander V. L. Cameron's Route across Africa, by W. J. Turner; London, Daldy and Isbister, 1877 (*W. J. Turner*). Kingdom of Bavaria, by C. F. Hammer. Nurnberg; Friedrich Campe, 1838 (*J. B. Johnston, Esq.*) Parts 14, 15, 16 of Spruner's Atlas of Medieval Geography; Gotha, Justus Perthes, 1876 (*Publisher*). Photographic Relief-map of the Yellowstone National Park, by W. H. Holmes. U. S. Geological and Geographical Survey of the Territories (*Prof. F. V. Hayden, U. S. Geologist*).

The Minutes of the previous meeting were read and confirmed.

The Secretary (*Mr. CLEMENTS R. MARKHAM*) read the following Resolutions, of which Sir M. Wells had given notice of his intention to move at the meeting of the Society on the 26th instant:—

“That a Committee of six Fellows of not less than ten years' standing be appointed to investigate the circumstances relating to the issue of visitors'

tickets, to whom, and by whom, such tickets were granted on the occasion of the Meeting of the Royal Geographical Society, at St. James's Hall, on Tuesday, the 12th day of December, and the authority for the same.

"That the officers of the Society be requested by the Council to furnish the Committee with such information as the Committee may deem necessary and advisable.

"That the following Fellows be appointed to act as Members of the Committee :—

Sir ALEXANDER ARMSTRONG, K.C.B. and F.R.S.,  
Colonel H. F. AINSLIE,  
Professor M. C. VINCENT,  
Sir MORDAUNT WELLS,

together with two Fellows of the same standing, to be nominated by the Council.

"That the President be invited to preside over the proceedings of the Committee.

"That three members of the above Committee shall constitute a quorum, and that the Committee be empowered to report the result of their proceedings at the Meeting of the Society to be held on the 12th of March, 1877.

"That the Meetings of the Committee be held at the office of the Royal Geographical Society, 1, Savile Row."

The following Minute of Council was also read :—

"Notice of the Resolutions to be moved by Sir Mordaunt Wells having been considered by the Council, it is ordered that the following Minute be attached thereto and read before the Meeting of this date :—

"The Council regret that on certain occasions of more than ordinary interest, Fellows of the Society have been unable to obtain seats.

"As the number entitled to be present of Fellows and visitors exceeds in the aggregate six thousand persons, it is obvious that some inconvenience and disappointment are unavoidable under any circumstances.

"It has also hitherto been the custom in this, as in other Societies, sanctioned by precedent and allowed by the courtesy of the Fellows, to set apart some space for the accommodation of the Council—their invited guests and distinguished visitors.

"In view of the above facts, the only question is, whether any alteration can be made in the Rules of the Society or in the practice hitherto observed on great occasions, which may, without injury to the best interests of the Society, tend to remove any complaints on behalf of the Members. Such a question the Council are the first to acknowledge is a proper subject for investigation by a Committee.

"The Council, then, propose that a Committee should be appointed, consisting of an equal number of members of the Council and of Fellows of over ten years' standing, to be selected from the general body, the President of the Society being the Chairman ex-officio. The duty of the Committee will be to inquire into the working of the existent rules and practice and to report thereon, with liberty to recommend for the approval of a General Meeting any new Rules or modifications in practice with a view to remove as far as possible all causes of complaint or dissatisfaction.

"The Council recommend the course above suggested in preference to that proposed by Sir Mordaunt Wells, as being one better calculated to preserve that harmony and good feeling between the members of the governing body and the Society which has hitherto subsisted; and which cannot be disturbed without seriously endangering, not only the present interest, but even the very existence of the Society.

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"Retrospective action and inquiry can only be useful in so far as it may lead to the removal in the future of any just causes of dissatisfaction or complaint. In so far as it secures this end, and is the only object sought, the Council will feel it their duty to give every facility and assistance, and will rejoice if the result should be to relieve them of all further responsibility as to arrangements for the accommodation of Fellows and visitors, when meetings of more than ordinary interest attract numbers of such magnitude as to preclude the possibility of finding places in which every one can be seated to his own satisfaction."

Sir M. WELLS said that, in consequence of the unusual course which had been adopted by the Council, he wished to know exactly what was now the position of himself and those with whom he was acting. Was the Minute to be treated as an amendment by the Council to the Resolution which he had given notice of? He had been entirely taken by surprise by the course which the Council had adopted. He should certainly proceed with his Resolution, because the Minute gave the "go by" to what had already occurred. Those whom he represented were determined, as far as possible, to know by whom the patronage was exercised at the meeting at St. James's Hall, and before they consented to any amendment by the Council, or to any alteration of the Rules for the future, they would insist upon a full explanation of the past. He therefore insisted on knowing distinctly whether the Minute was to be regarded as a proposed amendment, or whether his Resolution was to stand by itself for the consideration of the Fellows. He had never before heard of a minute being appended to a resolution before the resolution had been submitted to a General Meeting.

The PRESIDENT said that, on the notice of motion being brought before them, the Council conceived that, inasmuch as Sir M. Wells had on two separate occasions publicly made a denunciatory sort of speech, impeaching the action of the Council, and the proposed Resolutions were also couched so as to convey some kind of condemnation, it was their duty not to let three such public announcements of a prejudicial character go forth to the world without stating distinctly what their course of action would be. If it was desired to have a Committee of Investigation composed of equal numbers of Members of Council and outside Fellows, and presided over by the President—a suggestion which Sir M. Wells had at the last meeting expressed himself perfectly satisfied with,—the Council were quite ready to meet him on that ground. They would invite the most thorough inquiry into all their policy in reference to the admission of visitors; but as Sir M. Wells was not now prepared to accept such a committee as he had approved of at the previous meeting, there was only one frank and straightforward course for the Council to adopt, namely, to call a special General Meeting, according to the Rules, to consider and discuss Sir M. Wells' Resolutions. The Fellows would then have an opportunity of deciding whether or not they would grant such a committee as was now proposed, and of pronouncing an opinion upon the policy which had hitherto been followed by successive Councils in reference to the admission of visitors, both at ordinary meetings and on extraordinary occasions, on a full and fair view of all the circumstances to which that policy had to be applied. The Council had provoked and invited no discussion: they had simply thought it their duty, after three public denunciations of their action, to append a minute of the course which they were prepared to follow.

The following Lecture was then delivered by the Author:—

*Introductory Lecture on Scientific Geography.* By Lieut.-General  
R. STRACHEY, R.E., F.R.S.

IN June last the Council of this Society determined to offer increased encouragement to the extension in a scientific direction of the Geographical work which the Society is designed to promote, and it was resolved that, amongst other means to this end, not less than three of the ordinary evening meetings should be devoted to the delivery of Lectures on Physical Geography in its several branches, and on other truly scientific aspects of Geography in relation to its past history, or to the influences of geographical conditions on the human race. It has further been thought desirable by the Council that this, the first of these Lectures, should be of an introductory nature; that it should indicate the general scope of those that are to follow it, and thus supply, so far as your time and my ability will permit, an outline of the principal scientific aspects of Geography, to be filled in with more ample details by succeeding lecturers.

In accepting this task at the request of the Council, I have been very sensible of the extreme difficulty of doing justice to it, and I must ask those among my hearers whose knowledge of the matters of which I shall have to speak exceeds my own, to view leniently any errors into which I may fall, or any want of due proportion that in their better judgment may be found in my treatment of the wide range of subjects over which a review of scientific Geography will necessarily lead me.

Science, whether applied to Geography or any other matter, is, in truth, nothing more than well-arranged knowledge, and its methods though first developed by the study of abstract quantity and of the physical forces of nature, are applicable to all the objects of our senses and the subjects of our thoughts. The foundation of all knowledge is the direct observation of facts, in which condition it is termed empirical; the conclusions obtained by the application of thought to the facts thus observed constitute science, which by a process of classification and comparison seeks for the causes of which observed phenomena are the results.

The comparatively late application of strictly scientific method to Geography was a necessary consequence of the conditions under which the facts it deals with have been acquired. Geography is that branch of study which has for its object a knowledge of the earth. In its earliest shape it viewed the earth almost exclusively as the habitation of man. The inquiries it made concerned the distribution of the land and water, the positions of

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the continents, islands, and seas, and of the plains, mountains, and rivers; the manner in which the land was divided into various countries, and occupied by various nations; the divisions of countries into provinces, and the situation of the chief cities; and it took note of many other matters concerning the language, customs, and modes of government, as well as of the climate and products of all the countries found on the earth. As travel extended and knowledge advanced, the earlier impressions of travellers as to the striking differences between distant countries were supplemented by the perception of co-existing similarities. Attention was drawn to the peculiarities which persistently characterise, at places widely separated, the great regions of cold and heat, the mountains and plains, the coasts and interior of the continents; to the local and periodical variations of temperature and climate, and of seasons of wind and rain, over certain areas of land and sea; and to the distribution of the principal branches of the human race and of the families of plants and animals. A large stock of facts of different classes was thus accumulated. But before these observations could be viewed as a connected whole, or the true significance of their mutual relation could be properly appreciated, it was necessary that considerable progress should have been made in many special branches of physical knowledge. The ancient sciences of mathematics and astronomy had first to receive the enormous additions which followed the revival of learning in the sixteenth century. The modern sciences of chemistry and physics, biology the science which was born yesterday, and geology the science which was born to-day, had all to throw their light on the facts which scientific navigation had brought together from every sea and land, before that conception could be formed of the close inter-dependence of all we see upon the earth, which renders possible a true science of Geography.

For the aim of this branch of science is to ascertain by what agencies and by what process the earth has acquired its existing forms and characteristics. And this inquiry appears to establish that the phenomena observed on the surface of our planet are in their chief features attributable,—first, to the action of the great physical forces, attraction and heat, controlled by the earth's figure and its movements on its axis and round the sun; and, secondly, to the configuration of the surface, and the distribution of sea and of low and high land: and moreover, that all the phenomena of animate as well as inanimate nature have been in the past, as they still are, governed and determined by these same forces and influences.

We further learn that the figure itself of the earth, and the outlines of its surface, have been due to the former condition of the planet, and to the gradual changes it has undergone in cooling from a previous much higher temperature; that these and other causes have operated through a past into the obscure distance of which our vision cannot pierce, and are still at work, producing changes of surface, from which, as direct consequences, arise modifications of climate, and corresponding variations in the forms and distribution of living creatures, vegetable and animal. In this manner has been evolved the face of nature as we now see it; nature, which working with never-varying forces through ever-varying forms, appears to man in the present as his type of stability, while leading from the hidden shapes of an impenetrable past to those of an unknown future.

It is evident that the original investigation of the causes of terrestrial phenomena requires a knowledge of physical science, both wide and deep. But though this be true, it puts no serious difficulty in the way of imparting a thoroughly sound knowledge of the results, when once attained, to those whom want of leisure and perhaps of ability, prevents from going more deeply into these subjects. Nor need such a knowledge as is thus gained be either superficial or of small value; in the words of John Mill, "to have a general knowledge of a subject is to know only its leading truths, but to know these thoroughly, so as to have a true conception of the subject in its great features;" and it is hardly needful to insist on the advantage of having true conceptions in place of false or none, of such familiar objects as those which Physical Geography deals with. I therefore ask you, without hesitation, to discard all objections to including scientific geography in the course of an ordinary education, which are founded on the variety and complexity of the subjects it includes. These objections have, in truth, their origin in the too general absence of scientific knowledge which characterises a generation that has not itself received even an elementary education in physical science; standing in the same position with regard to these matters, as men who can neither read nor write stand in to the world of letters. It is one of the special functions of associations such as the Geographical Society, to aid in removing obstacles like these from the way of improved education: our Society may justly claim some pre-eminence in the steps it has already taken in this direction; and I feel satisfied that your intelligent support will be given to its steady progress in the same course.

In proceeding to present to you, in a succinct form, a connected view of the principal matters that fall within the range of scientific Geography, I shall first touch upon those that more closely depend on the figure and movements of the earth viewed as a whole, and afterwards pass on to those in which the influence of local conditions becomes more marked; the former, speaking generally, affect more immediately inorganic, and the latter, organic matter.

The intimate relation between geography and astronomy is at once suggested by the essential importance to the geographer of a knowledge of the methods of determining the magnitude and true form of the earth, and of ascertaining position on its surface. It is of the highest interest to contemplate how man, with no other aid than his wonderful reasoning faculty, deduced from observations of the apparent motions of those heavenly bodies from which an impassable gulf divides him, the exact figure and dimensions of the globe on which he stands, of which he had as yet seen but a very small part; and how he extended this knowledge to the magnitude, the distances, and the laws that regulate the movements, of the whole planetary system to which the earth belongs.

Leaving the obscure origin of conceptions on these subjects to be sought for in Babylonia or Egypt, it is to Greece that we turn to find the first definite scientific opinions. Thales of Miletus, 640 years before the Christian era, already taught that the earth was a sphere. To his successor, Anaximander, is attributed the invention of maps; and his disciple, Pythagoras, suggested the true doctrine of the revolution of the earth on its axis and round the sun, though this conception dropped out of sight for centuries.

Eratosthenes, of the Greek school of Alexandria, in the third century before Christ, is said to have first determined the magnitude of the earth, adopting for the purpose the principle still in use.

Hipparchus, of the same school, who lived a century later, was the greatest of the Greek astronomers, and his additions to the science were truly remarkable. He discovered the precession of the Equinoxes, or the periodical change of direction of the earth's axis from east to west, in the opposite direction to its motion in its orbit; and the eccentricity of the sun's apparent orbit, the inequality of its motion, and its distance from the earth. To him is due the system of fixing geographical position by means of latitude and longitude, and the method of calculating longitudes from eclipses of the moon.

Ptolemy, about 150 A.D., was the last eminent man of this

school. He collected all determinations of latitude and longitude of known places, and laid the foundation for correct methods of projection for geographical maps or charts. He is better known, however, by his treatise on Astronomy, which long continued to be the great authority on such subjects, and which caused his name to be given to the conceptions of the solar system it contained, though these were really due to his predecessors.

From this time until the sixteenth century—a space of 1400 years—no additions of any importance were made to this science. The study was revived in the ninth century among the Arabs, by whom the treatise of Ptolemy was translated into Arabic; and it was mainly through the teaching of the schools established by the Mahometans in Spain, and thence transmitted to Italy, that the knowledge already acquired was retained, and eventually so vastly extended. It was a little after 1500 A.D. that Copernicus put forth the view, this time to be finally accepted, that the earth and planets move round the sun. The almost simultaneous discoveries at the commencement of the seventeenth century of Galileo and Kepler, completed and corroborated this theory, and so opened the way for that explanation of the whole series of astronomical phenomena by the operation of the law of universal attraction, which is due to the genius of Newton.

A great impulse was given to precise geographical knowledge by the invention of the telescope and the pendulum, and their application to astronomical and geodetic observations. These led immediately to more exact determinations of the figure and dimensions of the earth. The measurement of an arc of the meridian in 1669, by Picard, gave Newton the means of verifying his theory of gravitation, and led to the recognition of the earth's ellipticity, as well as of the variation of the force of gravity at the surface with change of latitude, indicated by the varying time of vibration of a pendulum. Nothing then remained to be done in this direction but by the employment of better methods in detail, and of improved instrumental appliances, to attain results of greater accuracy.

Methods of calculating latitude, and instruments suitable for applying these methods, were comparatively soon devised. The difficulty of determining longitude was far greater, nor could it be overcome until correct clocks were constructed. The use of chronometers, the discovery of the telescope, and the progress of mechanical art, which produced instruments capable of measuring angular distances with accuracy, created scientific navigation. The practical application of this science has in our time opened



out ways to the most distant parts of the globe, along which the skilful mariner passes in complete security at a speed which now makes every part of the habitable seaboard, however remote, more accessible than were many places in our own islands hardly a century back. To produce such practical triumphs the accurate representation of the surface by maps or charts was essential. The reproduction of the details of a spherical surface in a rigorously exact manner on a plane, such as a sheet of paper, being necessarily impossible, much ingenuity has been applied to devising the best methods for approximating to the truth. The exact measurement of the earth's dimensions, on which the accuracy of all delineations of the surface depends, is a task involving much difficulty, and calling for rare abilities in the geodetic surveyor.

And here let me dwell for a moment upon the very great practical value of those compendious contrivances for conveying information to the mind, diagrams and drawings, which are little, if at all, less valuable than written language. Their special power consists in bringing clearly within the reach of apprehension, at the same moment and in suitable juxtaposition, a great multitude of objects interdependent but different, and so producing an intelligent connected conception of the whole, often without effort, and always with a clearness that no verbal description could secure. I desire to invite particular attention to this subject, feeling assured of the utility of maps or illustrative diagrams in dealing with the many complicated phenomena that present themselves to the scientific student of Geography. A certain fair facility for making such maps or diagrams may be acquired as readily as writing. Man has long been distinguished from other animals by the faculty of speech, and Professor Huxley has lately reminded us that he is the only drawing animal. These faculties correspond with the "two ultimate modes by which it is possible to implant ideas apart from actual experience, viz., narrative and diagram;"\* and he who possesses both tools doubles his power of obtaining and imparting knowledge.

Having thus traced the growth of our knowledge of the earth's figure, and the relation of geography to astronomy, I pass on to notice briefly the parallel onward course of geographical discovery.

Scarcely less admirable than the sagacity of the astronomers of the past, have been the enterprise and perseverance of that succession of able men who, by journeys over land and sea, have

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\* I have taken these words from an Essay on Science and Language, by my friend Colonel Dickens, R.A.

furnished positive evidence that the earth is in fact the globe which man's reason had taught it to be, and who have brought together, in defiance alike of the rigours of the elements and the barbarous nature of uncivilised man, the ample stock of knowledge which we now possess of the entire surface of the earth.

Like astronomy, Geography originated in Egypt and Greece. The earliest geographical conceptions were necessarily based on ideas of position in relation to the locality where the ancient geographers lived and wrote, and upon these the gradually increasing knowledge of the civilised world was engrafted, and developed around the eastern end of the Mediterranean Sea. Herodotus, writing 450 years before the Christian era, may be taken as the exponent of the earlier forms of Greek geography. The junction of the Mediterranean with the Atlantic was then known; ideas of the North and West of Europe were vague; the form and position of the Caspian were fairly ascertained; the descriptions of India do not extend beyond the Upper Indus; and the coasts of Asia seem to have been unknown beyond the Persian Gulf. The circumnavigation of Africa is referred to, but it may be doubted whether this was more than mythical.

Alexander's expedition, 330 B.C., reached the Indus; some of the Greeks who accompanied him went into India Proper; while on his return Nearchus followed the coast from the Indus to the Persian Gulf.

Up to the Augustan age, the only additions to Geography were obtained through the Roman conquests in Western and Northern Europe. In the time of Pliny, the coasts of Asia had hardly been traced with certainty beyond the mouths of the Gauges, and only vague conceptions of China had been formed. These had become more defined, and extended to the Malay Peninsula, Sumatra, and Java, by the time of Ptolemy, A.D. 150.

Till the end of the twelfth century, the further progress of geographical, like that of all other branches of knowledge, was very inconsiderable. Something was done by the Arab geographers in the early period of the growth of Mahometan power, and something by Norwegian Vikings. But in the thirteenth and following centuries, when the civilisation of Europe was becoming consolidated, the spirit of enterprise was gradually awakened, and led to great results.

The institution of the orders of friars, the desire to spread Christianity, and the terror produced by the incursions of Jenghiz Khan into Eastern Europe, were followed by journeys, of which one of the most remarkable was that of the monk Rubruquis into Central Asia. The growth of commercial activity sent forth the

Polos on similar expeditions. The knowledge of Central and Eastern Asia thus obtained, formed almost the whole of our stock up to our own time.

The formation of the powerful republics of Venice and Genoa, and the spread of their commerce, under the stimulus of many causes of which the Crusades may be reckoned as one of the most prominent, led somewhat later to the development of maritime habits, knowledge, and enterprise, among the nations bordering the Mediterranean, which at length found their expression in the series of great voyages of discovery which are among the most remarkable events of the world's history.

The Portuguese, as the result of systematic and continued effort, reached and doubled the Cape of Good Hope, arriving on the coasts of Western India in 1497. Nearly at the same time Columbus, following a truly scientific course of induction, for the first time so applied by man, embarked on the celebrated voyage which led him to the West Indian Islands in 1492, and which was soon succeeded by those in which he reached the continent of South America, near the mouths of the Orinoco. Cabot rediscovered the coast of Newfoundland. In the first half of the sixteenth century, Magellan started on the voyage in which the circumnavigation of the globe was for the first time accomplished by a circuit round South America and through the Pacific. Cortez advanced into Mexico; Pizarro and others turned southward along the Pacific to Peru and Chili. The Portuguese gradually explored the southern coasts of Asia, reaching the Moluccas and southern China; and the coasts of Japan and northern China became known through the Portuguese pirates. The beginning of the seventeenth century supplied a knowledge of the coasts of Australia, the Dutch from their colonies in Java having sailed round the west and north coasts in 1627, and discovered, under Tasman, the south coast, New Zealand, and Van Diemen's Land.

Thus in a period of less than 150 years was acquired the knowledge of the main outlines of the great areas of land and sea, to complete which in more exact detail has been the task of succeeding generations.

The later voyages of the seventeenth century were undertaken chiefly by privateers and buccaneers, of whom Drake and Dampier were the chief. Towards its end began the expeditions specially despatched by various countries for purposes of scientific discovery; and second to none have been those sent out by England, beginning with Halley, including the voyages of Cook, and ending with those of Nares.

In our own time geographical exploration has been chiefly directed to the Arctic regions, and the interior of the great continents of Africa, Asia, and Australia; and it was in the earlier part of the present century that arose the conception of scientific geography, in connexion with which will ever be remembered the name of Alexander von Humboldt.

The study of Magnetism has an unusually close connexion with the progress of geographical research.

The general properties of the magnetic needle were known and applied to navigation in Europe as early as the tenth or eleventh century, but much earlier by the Chinese. The variation of the declination, or deviation of the needle from the true north, at different places, was probably known before the time of Columbus, but to him seems to be due the observation of the gradual change which takes place in sailing westward across the Atlantic, until a line of no variation is reached, beyond which the variation becomes easterly. The conception of the earth being a magnet is due to Gilbert, an Englishman, about 1600 A.D. Halley, about 1700 A.D., suggested the idea of four poles of magnetic force, to the influence of which the complicated movements of the needle might be referred.

The results of magnetic observation as now collected, establish that there are, in fact, four magnetic poles, and that the magnetic force exhibits a series of periodical variations, both in respect to its direction and its intensity, dependent on the time of day, of the year, and the succession of years, as well as on the place of observation. The variety and complexity of these phenomena are great, and they are regarded as the results of electrical currents, established at or near the earth's surface, and due in some unknown way to the earth's revolution on its axis and round the sun, and to the heat emitted by that body. The application of the study of magnetism to practical navigation in these days of iron ships becomes a matter of very great importance.

The impress of the movements and figure of the earth is everywhere seen underlying the almost infinite variety of phenomena brought to our knowledge by the more and more complete exploration of the surface. It is these which determine the amount of heat received from the sun at any part of the earth; and regulate the distribution of temperature on which immediately depends the distribution of life. Everywhere we find alternations of what I may term terrestrial work and rest, consequent on the daily and yearly movements of the globe, which, subject to the influences due to the spheroidal form of the earth and the direction of its axis of rotation, give rise to the varying length of days and of

seasons at different places, and to a multitude of other recurring phenomena which characterise the animate and inanimate world. Day and night, summer and winter, active life and sleep, or hibernation, periodical winds diurnal or prolonged, seasons of rain and drought, are among the best known of these. The tides and the less well-known but equally regular periodical oscillating movements of the atmosphere obey the same general laws. A great number of other secondary phenomena carry out similar effects through all parts of the earth, and into all the operations of nature, both on the land and in the waters; for instance, in the currents of the ocean, the periodical rise and fall of rivers, the migrations of animals, the increase and decrease of disease among men.

Though many of the effects observed would equally follow as consequences of the sun moving round the earth as a centre, yet direct evidence that the converse is the case is to be found both in the movements of the atmosphere and in the currents of the ocean. The winds and waters, as they pass over the surface of the earth, acquire a velocity of revolution corresponding with the latitude, being greatest at the equator, and diminishing gradually towards the poles. The velocity thus acquired gives an eastward impulse to all air or ocean currents moving from the equator towards the poles, and an apparent westward impulse to air and water moving the other way. This has long been recognised as the true cause of the peculiar directions of trade-winds and monsoons; and more recently as the efficient agency in determining the direction of the south-west and north-east gales that characterise our own coasts. The revolving storms or cyclones which are among the most terrible of the natural adversaries of man, carry with them an awful testimony to the true direction of the earth's revolution on its axis from west to east.

As the facts which most directly depend on the form and movements of the earth became more completely known, and as the related conceptions arising from their study were more clearly developed, an inquiry naturally began into the nature of the earth's solid crust, and of the forces by the action of which the surface has received its existing outlines, elevations, and depressions. The science of Geology is the result; and the relation of this science with Geography is what we have next to consider.

A very little observation and thought threw discredit on the ancient cosmogonies, and showed that they failed to give any satisfactory solution of the problems submitted by the advance of geographical knowledge. If the extravagant myths of Asiatic origin, which peopled the earth millions of years ago with races

of anthropomorphic demi-gods and heroes descended from the sun and moon, could not bear the test of facts; neither have those traditions fared much better which unveil the earth fully equipped with all the present forms of life, and specially prepared to be the dwelling-place of man no more than a few thousand years ago. Precise observation has now supplied satisfactory proof that the earth's surface, with all that is on it, has been evolved through countless ages, by a process of constant change. Those features that at first sight appear most permanent, yet in detail undergo perpetual modification, under the operation of forces which are inherent in the materials of which the earth is made up, or of those developed by its movements or by the loss or gain of its heat. Every mountain, however lofty, is being thrown down; every rock, however hard, is being worn away; and every sea, however deep, is being filled up. The destructive agencies of nature are in never-ceasing activity: the erosive and dissolving power of water in its various forms—the disintegrating forces of heat and cold—the chemical modification of substances—the mechanical effects produced by winds and other agencies—the operation of vegetable and animal organisms—and the arts and contrivances of man—combine in this warfare against what is. But untiring nature immediately builds up again that which it has just thrown down; hand in hand with this destruction, nay, as a part of it, there is everywhere to be found corresponding reconstruction. If continents disappear in one direction, they are rising into fresh existence in another. Though the ocean tears down the cliffs against which it beats, the earth takes its revenge by once more upheaving the ocean's bed. And thus the globe has passed in succession through an infinitude of anterior states, by small modifications extending over a vast period of time, but not differing in essentials from those which are now seen to be going on.

The far greater heat of the interior of our globe, which increases about  $1^{\circ}$  Fahr. for every 50 or 60 feet of depth, gives us conclusive evidence that it has reached its present condition from a former state of much higher temperature. As the exterior gradually cooled, contractions necessarily ensued with consequent change of form and dimensions; and to these, acting in combination with gravity, were due the disturbances of the earth's surface, which have caused its greater irregularities. The strains set up by these forces may have continued to cause movements for a vastly prolonged period, and are probably still in action. Recent speculation has suggested that even volcanic phenomena may be

consequences of the heat developed by the intense pressures set up by the mechanical forces concerned in these movements of the cooled outer solid crust, and not results of the very high temperature which almost certainly still subsists at great depths in the interior.

In the absence of any direct means of ascertaining the condition of the earth's interior, aid has been sought from astronomical science, by which it has been established, that the thickness of the solid outer shell of the earth must be considerable; and that if the interior is in a fluid state at all, it must be covered by a great thickness (probably not less than several hundred miles) of solid, comparatively unyielding matter; and it is argued with apparent force that no connexion can exist, by which molten matter could pass between such depths and the surface.

As the mountain ranges are areas of elevation due to the pressures developed by the contractions of the surface, so the chief valleys commonly follow fissures along the lines of rupture; and their directions are determined by the lines of tension produced by the same mechanical strains which accompanied the elevations; mathematical science here, too, has come to the aid of geography and geology, in suggesting explanations of many characteristic directions of the elementary portions of mountain masses.

In the ocean we see the waters of the earth accumulated in the depressions formed on the surface in past time. The great continents occupy the areas that have risen in comparatively recent periods, and the clusters of islands probably indicate the remains of former continents now disappearing. We find in many directions evidences of movements on a very large scale, which lead to the conclusion that most of the existing great mountain chains have received their present prominent altitudes in almost the latest geological periods; and that during, or since those periods, the forms of the land and sea have greatly altered. Other indications, however, are not wanting, that some of the great features of land and sea, as we now find them, have been preserved for very long periods, and these may possibly be relics of the earliest forms taken by the surface soon after it attained a solid condition.

There was at first no little disinclination to accept theories which required vast periods of time in order to account for the observed facts of geology by forces now in operation. But these difficulties have at length disappeared, and with them the school that explained the great differences between the past and the present, by a series of catastrophes, or convulsions of nature, for which we have no authority in actual experience.

Should any difficulty arise in conceiving how such vast movements as those of which we see the results in mountains like the Himalaya or the Andes, and in the analogous depressions of the bed of the ocean, can have been produced by a mere secular change of the earth's temperature, I would remind you that the forces called into action by the earth are proportionate to its magnitude, and that its parts must be viewed in relation to that magnitude also. It has been calculated on sound data that the contraction of the diameter of the earth, consequent on the fall of temperature from a fluid state to its present condition, has been about 190 miles. At this rate a subsidence of 5 miles, which is the approximate greatest depth of the ocean, would correspond to a fall of temperature of about  $200^{\circ}$  Fabr. But the actual elevations and depressions of the surface have probably been produced by a comparatively much smaller loss of heat, being due rather to tangential strains than to any direct subsidence.

An illustration may assist you in forming a truer estimate of the irregularities of the earth's surface, which, though apparently great, are insignificant when viewed in relation to its actual dimensions. This hall might contain a globe 40 feet in diameter. If it represented the earth it would be on a scale of 1 foot to about 200 miles, and 1 inch would be equivalent to a distance of  $16\frac{2}{3}$  miles, or 88,000 feet. On such a globe the difference between the polar and equatorial diameters would be less than 1 inch, and the greatest elevations in Britain would rise to about the thickness of a three-penny bit. The highest mountains and the deepest seas would be shown by elevations and depressions of hardly more than  $\frac{1}{3}$  of an inch; and if they were distributed as such features are on the actual earth, they would be visible only with difficulty, and to your unaided eyes would in no way interfere with the apparent perfect smoothness of the globe's surface.

But the irregularities of the surface constitute only a small part of the effects of internal heat on the earth. Mineralogy is the branch of science which treats of the many simple and compound substances, that have issued under the operation of chemical forces from the vast laboratory contained within the cooling crust of the once incandescent globe. The spectroscope shows that the original materials of which all these substances are made up are the same as those that constitute the sun and other heavenly bodies, thus confirming the conjecture that all of these bodies are the results of the aggregation of matter once diffused in space. The waters of the ocean we must regard as a residual liquid product, resulting after those combinations were completed which supplied



the solid parts of the earth. In like manner, the atmosphere is the residue of the gaseous matter, after all the requirements of the laws of affinity had been elsewhere complied with; and it is not a little remarkable that these two subsidiary collections of matter, as I may term them, the air and the sea, which constitute a mere film on the earth's surface, should exercise so predominant an influence on terrestrial economy.

The area of the dry land is very greatly exceeded by that which is covered with water. The whole surface of the earth being 196 millions of square miles, about 51 millions are land, and 145 millions water. The average height of the land above the sea-level is also very much less than the average depth of the sea-bottom below that level, so that a rearrangement of the surface is quite possible by which the whole of the land might be submerged with comparatively little disturbance of the present level of the sea, or reduction of its average depth.

The mobility of water, and its properties in relation to heat, more especially that of evaporation, make the ocean one of the most important elements of terrestrial existence; it furnishes to the atmosphere the moisture which is one of the essentials of life, and serves by the circulation of its waters to equalise greatly the temperature of the globe, moderating the extremes both of heat and cold. The greater or less proximity of the sea directly affects climate; and the relative position of land and sea areas frequently determines the directions of the prevailing winds, while the formation of the coasts, their directions, and the depth of the bottom, immediately affect the flow of oceanic currents, and the distribution of heat through their means. The position and magnitude of mountain-ranges have also often an indirect influence on these actions of the ocean; they lead to the discharge into it of great volumes of fresh water from rivers, whereby currents are originated or modified, and they cast on its surface those vast masses of floating ice, which carry the temperature of the polar regions with them, far into the temperate zone.

The application of mathematical reasoning to the complicated phenomena of the tides of the ocean offers a striking illustration of the success of such methods, and of their great practical utility. They have supplied the theoretical knowledge which enables us to calculate, after a comparatively short preliminary process of observation, the daily and hourly periods and extent of the rise and fall of the tides at any part of the ocean; thus meeting one of the great wants of the seaman. The attraction of the sun and of the moon directly tend to produce a tidal

wave which shall follow the apparent place of the moon, moving from east to west, or in the opposite direction to that of the earth's revolution; but though this result is actually produced in the more open part of the ocean, yet the distribution of the great masses of land is such that the law can only very partially be complied with; in fact, in our own seas the tidal wave moves generally from west to east, or diametrically in the opposite direction to that of the force which generated it. This affords another of the numerous illustrations of how greatly local conditions of surface affect the operation of the great forces set up by nature.

Among the influences which give to the earth the characteristics that most immediately affect its fitness for occupation by man, those of the atmosphere are, without doubt, the most prominent. These influences, under the general designation of climate, are constantly affecting us. Of all branches of science, that which treats of the atmosphere—Meteorology—is at the present time certainly the most backward. The reasons are not far to seek. The air is invisible, and, for the most part, inaccessible. The changes it undergoes take place with great rapidity; they are difficult to observe, and, from their great complexity, difficult to grasp. It is pretty certain that the essential causes which operate on the atmosphere are changes of temperature; but the application of mathematical reasoning to the movements of elastic fluids when submitted to changes of temperature, is accompanied with great difficulties, and very little has been done to grapple with them. What we know then of these subjects is as yet almost exclusively empirical. Our instrumental appliances are here far in advance of our theories, and it is not to be disguised that great waste of labour too frequently results from an exaggerated refinement in observation, which has no real value.

The air, though highly attenuated, constitutes a fluid-medium beneath which the whole surface of the earth is immersed, and by which all that is on it is surrounded, supported, and penetrated. The air is the vehicle through which warmth and moisture, and the gaseous necessities of life are supplied to all that is on the earth. With the ocean, the air performs the part of equalising temperature, and preventing excessive accumulations or losses of heat; and as the ocean supplies the source of moisture, so the air distributes it, first absorbing and then delivering it up at some distant place. The very great activity of the air in carrying out these functions is truly remarkable. If the whole quantity of moisture in the air at any moment were condensed so as to leave it absolutely dry, the resulting stratum of water, if

distributed evenly over the whole earth, would be less than 1 inch in depth. Yet it is estimated that the mean rainfall over the whole globe is not less than 60 inches in the year, and falls of ten times this amount are known to occur in some localities. Actual observation of the velocity of the wind at marine stations, shows that such results may readily be due to the almost unceasing passage of saturated air over the regions where, and during the time in which, rain thus falls, and to the unceasing renewal of the supply of moisture by evaporation. The relatively very large total sea-area has an important effect in facilitating the supply of the rain that falls on the land; and the actual distribution over the earth both of heat and moisture is largely dependent on the local distribution of the land and ocean areas.

Our observation is almost necessarily limited to the lower regions of the air. But it is to be remembered that three-fourths of the air in weight is found within 30,000 feet, and nine-tenths of the watery vapour and half the air within 20,000 feet of the surface. Hence it is certain that the movements near the surface are those that chiefly affect all conditions of climate, though no doubt there are great movements in the upper regions to bring about the restoration of equilibrium, which is being constantly disturbed below.

The principal periodical winds—such as the trade winds, the monsoons, the land and sea breezes—are easily explained, and are found to be essentially dependent on periodical variations of atmospheric pressure, accompanying variations of temperature due to geographical conditions. The proximate causes of the more characteristic winds of the north of Europe, and especially of our own islands, appear to be also well made out. They, too, are disturbances of pressure; the rapidity and intensity of which and the manner of their transfer from one area to another, determine the force of the wind, the direction in which it blows, and the manner in which it veers. But how the changes of pressure are produced, and what causes the transfer of the disturbed area in a definite direction (usually from west to east) we have still to learn; though here, too, it is obvious that the formation of the surface, the distribution of the land and sea areas, and of the ocean-currents, are among the principal agencies at work. The winds of our islands have commonly, more or less distinctly, the gyrotory character which is one of the secondary results of the revolution of the earth. The precise conditions under which the great cyclones or hurricanes of the tropics are generated have still to be discovered, but we have a sufficient know-

ledge of the manner of their occurrence to enable the instructed mariner in most cases to escape their worst consequences. That these winds also are strictly due to local terrestrial influences cannot be doubted.

The action of the periodical winds in producing the seasons of rain in the tropical and semi-tropical regions of the earth, is of the greatest practical moment, the water-supply and the production of the ordinary food-crops being often wholly dependent on such rains; and the search of science into the controlling causes of their failure and abundance, may result in enabling us so to foresee the possible occurrence of drought as to guard against its worst consequences.

The immediate dependence of rainfall on local geographical features is too well known to call for more than a passing remark. The presence of mountains forming a barrier in the path of the vapour-bearing winds may determine, on the one side a climate of perpetual cloud and rain, and on the other vast tracts of desert. Where no mountains exist to cause condensation such winds pass on, leaving deserts behind them, and carry their waters to fertilise more distant lands.

A well-known consequence of the physical properties of the air becomes apparent under the influence of elevation of surface, in the gradual reduction of temperature observed as we ascend mountains. This amounting to  $1^{\circ}$  for about 300 feet of elevation, gradually produces a change of conditions similar to that caused by receding from the equator towards the poles; and at the greatest elevations an arctic climate is established even under a tropical sun.

The great ranges of mountains entering the regions of perpetual snow, which traverse the tropics or approach them, are among the sublimest of the sights furnished by nature. Here, by the intrusion of the solid terrestrial surface into the upper parts of the atmosphere, the low temperature, which otherwise could have produced no effect on the earth, is brought into active operation; and the results are carried down in the form of great rivers, which fed by the melting fields of ice, or the copious condensation of rain on the mountain slopes, fertilise the plains beneath as they pour forth their never-ceasing streams.

Whether in the shape of glaciers in their mountain beds, or as the floating fragments of glaciers that form icebergs, or when merely producing disintegration in the fissures of rocks, ice is one of the most energetic of destructive agents. The recurrence of glacial epochs with alternations of periods of greater heat, in

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the earth's past history, of which geology supplies apparent evidence, is of much interest, and has given rise to much speculation. Among possible causes of this are to be reckoned the variations of the form of the earth's orbit, which, combined with the changes of position of the axis in relation to the points of least and greatest distance from the sun, due to precession, appear capable of producing very considerable effects on the summer and winter temperatures of the two hemispheres, without affecting the mean temperature of the globe. Actual displacements of the earth's axis of rotation have also been suggested as a means of accounting for these great local changes of temperature; but the evidence in this direction has hardly yet been carried beyond arguments, based on mathematical reasoning, to show that such displacements are not incompatible with established facts.

A few words will indicate the magnitude of those forces which are called into silent and comparatively unobserved operation in the atmosphere by the sun's heat. It has, as I noticed, been estimated that on the average 5 feet of water falls annually as rain over the whole earth. If we suppose that the condensation takes place at an average height of 3000 feet above the surface, the force of evaporation must be equivalent to a power capable of lifting 5 feet of water over the whole surface of the globe 3000 feet during the year. This would involve lifting 322,000 millions of pounds of water 3000 feet in every minute, which would require about 300,000 million horse-power constantly in operation. This calculation does not include the force required for the transport of the rain in a horizontal direction. But such numbers cease to convey any precise signification, and I will therefore add, that the engines of the largest ironclad do not exceed 8000 or 9000 horse-power. Of the huge energies thus exerted a very small part is transferred to the waters that run back through rivers to the sea, and a still smaller fraction is utilised by man in his water-mills. The rest is dissipated in tending to equalise the temperature of the celestial spaces and what is therein.

We have now seen how, under the action of inherent or external forces, the globe has been moulded to its present form, and has received the existing configuration of its surface; and how from these have resulted all local characteristics of climate, fitting it for the support of life. We thus find ourselves at the mysterious line which separates inorganic from organic matter.

Of the origin of life, either when or how it began, we know nothing; all that can be said is that the earlier conditions of the earth were altogether incompatible with life as we know it. For

thousands of years, as the globe cooled down, its surface must have been deluged with boiling water; and until a temperature had been established not very greatly exceeding that of the present, none of the forms of life found in the oldest fossiliferous rocks could have subsisted. And life is restricted to a very thin stratum at the surface, hardly more than one thousandth part of the earth's diameter—the proportion of a coat of varnish to an ordinary globe.

The old received sharp distinction between animal and vegetable is quite broken down. The bond that subsists between things with and things without life, is testified by the identity of the elements of which they are all composed; the absence from the materials of which the earth is formed, of a single one of certain elementary substances, such as oxygen or carbon, would have rendered what we know as life wholly impossible. The only conclusion is that life is in its nature analogous to other properties, of whose connexion with matter we are equally ignorant; and that it is in fact in some unknown way a necessary adjunct or consequence of matter in certain conditions.

Scientific theories of life must be based on the study of the structure and distribution of existing plants and animals, and of the corresponding facts established by the aid of geology. These teach that all things having life exist in groups, such as vegetables and animals, mammals and birds, cats and dogs, and so forth; among which may be traced various degrees of structural affinity, gradually increasing, until we at length reach individuals known to be related by descent from a common ancestor. We also find that the assemblages of creatures in countries easily accessible to one another, and alike in climate, closely resemble one another; that as distances increase, and communication becomes less easy, and climate less similar, differences in forms of life are more marked; and that great distance and complete separation are generally accompanied by a total change of forms. Distance in geological time has the same effect as distance in space: the further we go back into the past, the more different were the forms of life from what they now are.

These were the phenomena to be accounted for. The problem was, whether or not this could be done by having recourse to the only means which direct observation shows to be capable of producing living creatures, propagation by generation through descent from parent to offspring. The answer has been given in the affirmative by Darwin, to whom we are indebted for a theory of life analogous in its breadth and the genius it displays to the great conceptions of Newton. Darwin has shown how pro-

pagation by descent, accompanied by certain small variations in the offspring, such as are known to occur, would be followed by the necessary preservation of some of the varieties to the exclusion of others, and how this would account for many of the facts observed, while inconsistent with none. To the preservation and destruction of forms by reason of favourable or unfavourable external conditions, he has applied the term Natural Selection. He has thus explained how it is that uniformity of conditions and facilities for diffusion over any area are found in connexion with similarity of forms of life throughout the area, and how any break of continuity of conditions, or surface, or time, involves differences in forms of life. Great tracts like northern Europe and Asia, extending along the same parallels of latitude, not broken up by high mountains, are biologically one. Great mountain ranges like the Himalaya, and great deserts, constitute impassable barriers. Isolated lands, like Australia, are almost wholly dissociated in their life from other countries. The same results are found in the seas. With the rapid variations of climate that occur on lofty mountains rising from tropical plains, are developed numerous forms of life; on those ranging through many degrees of latitude, as in the New World, there is greater variety of life, corresponding to greater variety of climate, than on those nearly following the same parallel as in the Old World. Extensive land areas appear requisite for the evolution and support of the larger forms of terrestrial life, while restricted areas are characterised by smaller forms and fewer of them.

The laws that govern the diffusion and limitation of vegetable and animal life are similar; but a satisfactory correlation has not yet been established between the geographical distribution of vegetables and animals. For, though some of the great natural provinces marked out on the earth's surface by characteristic assemblages of plants and animals, respectively, are more or less continuous, this cannot be said to hold good as a rule.

Many apparent difficulties in accounting for the existing facts of distribution, are solved by a consideration of the many great changes that have taken place in the outlines of land and sea in past time. The data necessary for any complete solution of all the questions that arise are wanting, in consequence of our still very limited knowledge of the geology of many parts of the earth, and especially of extinct forms of life concealed beneath its surface. But every fresh fact discovered seems to strengthen the evidence of the actual occurrence of evolution, and of the general truth of Darwin's theory as to its essential factors.

The phenomena of which I have been speaking indicate much more than a simple conformity of life to the conditions under which it subsists; the conditions, in fact, have positively determined, and finally fixed, those forms that have been preserved, so that the general course of life, as it has been evolved in the past, is in essentials a mere sequel to the course of the material forms of the earth's surface.

Perfectly unbiassed evidence of the truth of this conclusion is found, in the tendency that had been shown before Darwin's great discoveries to give weight to geographical distribution in systematic classification. And though it be true that classification should rest wholly on morphological considerations, yet the structural likeness of forms geographically associated is often so complete, while so many links in the chain of evolution have been lost for ever, or still have to be found, that, on the one hand, distribution may without objection furnish collateral aid in the details of systematic arrangement, and, on the other, structural resemblances may serve to suggest changes of geographical conditions of which no other evidence remains.

The doctrine of dependence of life on external conditions includes life itself as an important concurrent agency in the general results observed. Thus, in order to supply the food and other requirements of animals, the presence of vegetables or other animals is necessary. To some animals, as well as to some plants, the shelter of forests or particular forms of vegetation is essential. Parasites need for their sustenance living plants and animals. The fertilisation and propagation of plants is very commonly due to insects; and the infrequency of certain forms of insect-life in some of the islands of the Pacific, is held by Wallace to be the true cause of the simultaneous infrequency of flowering-plants.

Nor is organic matter without a large reaction on the inorganic parts of the earth. The building up of coral-reefs; the laying out of extensive calcareous and siliceous deposits over the entire bed of the ocean; the action of vegetable life on the constituents of the atmosphere; the effects produced by vegetation in modifying the absorption and radiation of heat by the soil, and the conditions of moisture; afford instances of vital forces actively affecting the condition of the earth.

As life, viewed in one aspect, performs the function of sustaining life, so in another it works for destruction. It at once supplies food and the elements of decay. Among the latest results of science may be noticed those that trace epidemic diseases, with certainty among insects and plants, and with much probability among the



higher animals, to parasitical organisms; and show how these withdraw the necessary elements of healthy existence, and may at length lead to the total dissolution of the creature in which they are produced. And, like the forces connected with inorganic matter, life also follows the same incessant round of construction and destruction; it elaborates from the earth new combinations of matter, and again dissolves them, to restore to the earth the elements on which its own renewal depends.

In what I have been saying of living creatures, I have not distinguished man. for in all such respects he cannot be separated from the rest of the animate world in which he holds the most conspicuous place. The monuments of Egypt, which take us back perhaps 7000 years from the present time, mark a very brief stage in that journey through which we have come down from our four-handed progenitors. The human race existed in company with many mammalia now extinct, at a time far distant, when the outlines of sea and land and the conditions of climate over large areas were greatly different from what they now are; and modern researches have done much to exhibit its gradual progress to the historical period.

Man, with his special faculties and dispositions, all of which have been developed under the pressure of external influences, is still as directly dependent, in most respects, on the physical characteristics of the regions in which he dwells, as any other of the beings that possess the attribute of life. If, on one side, his ingenuity enables him to avoid the agencies which to other less sagacious animals are irresistible, and teaches him how to wield them for his own purposes, yet on the other, in doing this he is forced more completely than any other creature to shape his existence so as to conform to their inexorable sway.

The arts of civilisation by which man secures advantages not to be obtained from the unaided forces of nature, have now transferred the chief seats of his power from the warmer latitudes where existence was in times past most easy, to colder climates where the conditions are more favourable to the continued exertion of his intelligence. Civilised man compels the earth to increase its vegetable and animal produce, for the supply of his growing numbers. He breaks into the store of minerals hid away below the surface and converts them into power. He makes the ocean a highway over which he rides to pursue his ends in all parts of the globe; and thus uses an obstacle impassable to most living things, as the principal means of his own migrations.

But geographical features will ever continue to determine the

course of man's career, and to regulate his movements, be they directed by peaceful or warlike desires. History will always tell how nations have been born, have grown, and have perished, under the influence of causes that can be traced back to the material earth; and whether we call it mother country or fatherland, the soil under our feet, as in the Greek fable, is the true source from which we draw our bodily, mental, and social strength.

I shall close this review of the subjects comprised in scientific geography, which the forthcoming series of lectures, to which this is the prelude, are designed to illustrate, by briefly recalling the chief topics to which I have directed attention.

1. The figure and movements of the earth, and the progress of our knowledge of them.
2. The progress of geographical discovery, and its results.
3. Geographical methods, instruments, and maps.
4. The magnetism of the earth.
5. The ocean, its depths and circulation.
6. The tides of the ocean.
7. The dry land, continents and islands, mountains and plains.
8. The mineral constituents of the earth.
9. Volcanic action and the interior of the globe.
10. The atmosphere and the distribution of heat on the earth.
11. The winds and fall of rain.
12. Regions of ice and glaciers.
13. The distribution of vegetable and animal life in the present and past.
14. The races of men, and their dependence on geographical conditions.

These are the studies through which scientific geography will lead you, teaching you to view the earth in its entirety, bringing together the great variety of objects seen upon it, investigating their connexion, and explaining their causes; and so combining and harmonising the lessons of all the sciences which supply the keys to the secrets of Nature. Geographical knowledge may be aptly compared to the setting in which are gloriously held together the bright gems of science, to form an intellectual diadem for man. This study best supplies those wide fields of observation which are the true and only sources from which we draw our intelligence and originality; for the mind has no power of absolute production, but only of perception and comparison. It is the power of applying with rapidity and precision the thoughts suggested by external objects and their mutual relations, that constitutes originality and gives the means of invention. And this is as

true of imagination as of reason. For by the influence and study of external nature are formed and developed man's emotional, intellectual, and moral faculties.

The emotions created by the vast extent of ocean, its ever-moving surface, the changing outlines of land and sea, the richness and luxuriance of the vegetable clothing of the earth, the astonishing variety of animal forms, the many diverse races of men, the never-ceasing transformations of the clouds as they float overhead, the play of light and colour over the whole of these objects, the firmament set with stars that bounds our vision and expands our conceptions when we gaze into the unknown depths of space, the large serenity of nature at rest, her overwhelming violence in convulsion—these emotions are the source of all our ideas of the beautiful and sublime.

The strong stimulus afforded to curiosity and observation by the varied scenes of nature, is the necessary antecedent of that ferment of the mind which precedes intellectual activity. Hence the constant succession of new objects which greets man as he changes his place on the globe, exciting in him an interest not awakened by scenes of long-continued familiarity, is one of the most active agencies in arousing his desire for knowledge, the acquisition of which, as it is among the few permanent springs of our own enjoyment, so constitutes our best or only means of adding to the well-being of others.

The contact with other living beings which is a direct result of geographical discovery, teaches us man's true place in nature; our intercourse with other races of men in other countries teaches us what is humanity, and gives those lessons of civilisation needed to overthrow the narrow prejudices of class, colour, and opinion, which bred in isolated societies, and nourished with the pride that springs from ignorance, have too often led to crimes the more lamentable because perpetrated by men capable of the most exalted virtue.

Let past experience be permitted to show us the one way to certain future progress, the way opened by the increase of true knowledge; let us complete that conquest over our globe which is so eloquently described by the poet, when he makes the earth on the setting free of Prometheus, the type of human intelligence, burst forth in a song of triumph over the destiny of man, her latest born:

“The lightning is his slave; heaven's utmost deep  
Gives up her stars, and like a flock of sheep,  
They pass before his eyes, are numbered, and roll on.  
The tempest is his steed; he strides the air,  
And the abyss shouts from her depth laid bare,  
‘Heaven, hast thou secrets? man unveils me; I have none.’”

The PRESIDENT said they had listened to a lecture of the greatest interest, full of wise suggestions and instruction. In showing how enlarged was the scope of Geography, General Strachey had done good service. He had pointed out that mere descriptive geography was a very small portion of the great subject which the science embraced, and had thereby encouraged the Society to pursue the course of lectures which it had been thought desirable to begin. He was sure that all present would join in a sincere vote of thanks to General Strachey for his able and instructive address. Before the Meeting separated he wished to mention something which had only just come to the knowledge of the Council. The German Geographical Society at Berlin held a meeting on the 3rd instant, to hear an account of their travels from two successful African explorers who had just returned home—Dr. Lenz and Dr. Pogge. The latter gentleman had made a most remarkable journey, which would give him a high place in the list of African travellers. He had succeeded in penetrating from St. Paulo de Loanda to the capital of the renowned African potentate Muata Yanvo (or Yambo), a remote district which had hitherto never been reached by any explorer, and even but by few coloured Angolan traders. The capital, Musumibé, lay to the north of Kabebe, the seat of government of the preceding monarch, and many days' journey to the west and north of Cameron's line of march. Dr. Pogge travelled for the sake of pleasure as a hunter of the larger African game, and not as a scientific explorer; but some of the information he had obtained was of the highest interest, particularly as regards the healthiness and beauty of the interior plateau. He did not believe the Lualaba flowed into the Congo, but seemed to entertain no doubt that the Kasai or Cassabé was the upper course of the great river.

At the next meeting of this Society two interesting papers would be read—one by Lieutenant Young, who had just returned from Lake Nyassa, where a steamer had been launched and a settlement formed; and the other by Mr. Price, the adventurous missionary who hit upon the happy idea that a bullock-waggon road could be formed between the East Coast and Lake Tanganyika, and who had made an experimental journey with bullocks, and taken them to the upper highlands. He was now busy getting the most perfect bullock-cart that the manufacture in England could produce.

## ADDITIONAL NOTICES.

(Printed by order of Council.)

- 1.—*Report on the Congress of Orientalists (Third Session) at St. Petersburg.* By Captain F. C. H. CLARKE, R.A., Delegate of the Royal Geographical Society at the Congress.

SIR,

London, December 14, 1876.

As Delegate of the Royal Geographical Society to the Third Session of the International Congress of Orientalists, sitting at St. Petersburg in September last, I have the honour to make the following Report :—

In the domain of Geography, perhaps the most interesting feature of the meetings was the exhibition by Colonel Sossnoffsky and Dr. Piacetsky of photographs, water-colour drawings, raw and manufactured products, &c., illustrative of the nature and resources of the countries travelled over during the expedition of those officers to China in 1874-75. The object of their expedition, semi-commercial and semi-political, is set forth in the Report made by the former officer to his Government. Through his courtesy in supplying me with a copy, I am enabled to submit the accompanying abstract,\* embodying the gist of the geographical research, for the information of the Fellows of the Geographical Society. I believe the information to be very valuable, as it treats of a comparatively unknown part of the country.

Colonel Sossnoffsky intimated his intention of presenting to the Royal Geographical Society an album of photographs illustrative of his expedition, which will no doubt prove as interesting as it is valuable.

Among other communications of interest made to the Congress, was a Paper by Dr. Neumann, a gentleman in the Russian service, and Vice-President of the Siberian Section of the Congress, on his expedition to the Tchoukchis. An abstract of the Paper communicated to the Siberian Section of the Russian Geographical Society, of which that read before the Congress of Orientalists was an abridgment, is herewith submitted.

Lastly, an interesting Paper was read in the Central Asian Section by Mr. Tcharikoff, Secretary in the Department of the Archives in the Ministry of Foreign Affairs at Moscow, relating to the mission sent in the year 1669 by the Tsar Alexis, father of Peter the Great, to the Khans of Bokhara, Khiva, and Balkh, and giving some information of the condition of those countries at that epoch. A translation of his communication is likewise submitted.

In the domain of Cartography the list of maps and plans exhibited in the halls of the Congress is given in Appendix A. These maps are all of recent date. Besides these there was a very unique collection of less recent maps, charts, &c., of different parts of Asia, lent for the occasion by permission of the Minister of Foreign Affairs, and belonging to the Moscow Archives. A catalogue of these maps is given in Appendix B of this Report.

A list of the Presidents and Vice-Presidents of Sections is shown in Appendix C, from which it will be seen that four Fellows of the Geographical Society of

\* This abstract will be published in the 'Journal of the Royal Geographical Society.'

London, and three other Englishmen, of considerable repute in Oriental lore, were honoured by appointment as officers of the Congress.

In conclusion, it only remains for me to place on record the sense of gratitude of the English members, for the kindly manner in which they were welcomed, and for the hospitality and attention which they received at the hands of His Majesty the Emperor and of the community at large during their stay at St. Petersburg.

I have the honour to be, Sir,

Your most obedient servant,

F. C. H. CLARKE.

Sir RUTHERFORD ALCOCK, K.C.B., *President of*  
*the Royal Geographical Society.*

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APPENDIX A.—*Maps exhibited at the Congress.*

1. Map of the Turkestan military district, Tashkent, 1872. In 4 sheets: 40 versts to the inch.
  2. Map of the Territory of the Orenburg Cossack Contingent, showing the Kurgans. Original survey by M. Koroleff, 1876; 3 versts to the inch.
  3. Map of Hissar and of the Bekate of Kuliab, compiled from Vishnevskin's Notes (astronomical points by Schwartz) made during the Expedition of 1875, under Major Maeff. Original survey; 10 versts to the inch.
  4. Map of the Orenburg District (180 sheets); 10 versts to the inch. 1867.
  5. Map of the Naryn District, by Major-General Kraefsky, 1868, embodying the Reconnaissances of Baron Kaulbars in 1869. Original survey; 5 versts to the inch.
  6. Map of Kohistan, prepared during the Iskander Kul Expedition, by Startzeff and Klassen, under the direction of Baron Aminoff, 1870. Original survey; 5 versts to the inch.
  7. Map of the Western District of the Chinese Empire, from Chinese maps and other sources, by Messrs. Zakharoff (Consul at Kuldja) and Niphantieff. Original survey, 1858; 50 versts to the inch.
  8. Map of the Tian Shan Mountains, from Chinese maps, by Messrs. Zakharoff and Niphantieff, 1858. Original survey; 25 versts to the inch.
  9. Map of Dau Kara (Khiva) and neighbourhood, 1873; 5 versts to the inch.
  10. Map of the Khanate of Khiva and the lower course of the Amu Darya, 1873.  $\frac{1}{550000}$ .
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APPENDIX B.—*Indicateur des Cartes Géographiques et des Plans de différentes parties de l'Asie, appartenant à la Collection Cartographique de la Bibliothèque des Archives Principales du Ministère des Affaires Étrangères à Moscou.* (Rédigé par A. RATCHINSKI, employé aux archives, délégué au 3<sup>e</sup> Congrès des Orientalistes à St. Pétersbourg.)\*

1. Geographiae Blavianae—volum. Decimum, ubi Asia describitur. Amstelodami 1662 (imprimé), f. 3.

2. L'Asie, divisée en tous ses Etats, dressée et gravée par Chambon. Paris 1754 (imprimé), f. 12.

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\* The numbers of the folios given at the end of each article correspond with the folios of the Cartographical Catalogue in the Moscow Archives.

The numbers in black figures correspond with the ordinary numbers of the Catalogues.

3. Carte de la partie septentrionale et orientale de l'Asie, qui comprend la Grande Tartarie, le Kamtchatka et Yesso avec la mer Glaciale et ses côtes, dressée en 1764 par M\*\*\* (gravé), f. 13.

4. Carte de l'Orient, dressée par M. Kehr, professeur de langues orientales ; contient les pays situés entre les 50° et 131° de latitude : de la Nubie jusqu'aux frontières de la Chine à l'Orient (nomenclature de toutes les localités en arabe) ; quelques-unes dans l'Inde, la Tartarie et dans les possessions chinoises en chinois (manuscrit).

5. Une autre carte de moindre dimension, mais détaillée, des terres Karakalpaks et Ousbeks (manuscrit), f. 13. No. 10.

6. Imperii Russici et Tartariae universae tam majoris et Asiaticae quam minoris Europae tabula. Auct. Joh. Math. Hasio. 1730 (imprimé), f. 15. No. 1.

7. Siberiae veteris Tab. I. en allemand, lettres latines f. 16.

8. La Russie Asiatique, tirée de la carte donnée par ordre du feu Czar (imprimé), f. 17. No. 17.

9. Nova descriptio Geographica Tartariae magnae tam orientalis quam occidentalis cum delineatione totius Imperii Russici imprimis Siberiae accurate ostensa. Auct. Philippus *Stralenberg* (manuscrit), f. 17. No. 18.

10. Carte de l'Empire de Russie et d'une partie de l'Asie centrale d'après les notions des Chinois ; dressée sur une charte chinoise (manuscrit), f. 18. No. 32.

#### GOUVERNEMENT D'IRKOUTSK.

11. Carte générale de tout le royaume de Sibérie avec indication des limites des provinces de Tobolsk et de Tomsk, des routes, des chefs-lieux, des commandants, des garnisons et des limites au sud de la Sibérie (manuscrit), f. 36. No. 1.

12. Carte des districts d'Irkoutsik, Sselenginsk, Nertchinsk, et d'une partie de celui d'Ilimsk. Dressée par le géomètre *Skobéltzine*, transmise au collège des affaires étrangères par le vice-gouverneur de Tobolsk *Boltine* en 1730 (manuscrit), f. 36. No. 6.

13. Lieux des campements des nomades : Ostiaques, Tounougouss, Yakoutes, Youkagirs, Kariaks, Kamtchadales de différents idiomes et des Tschoukitchi : des bords de l'Irtyche jusqu'au pays Schélaginsk et Tchoukote (manuscrit), f. 36.

14. Une partie des districts de Mangasei et de Léna, avec les embouchures des fleuves Yénisséi et Léna, dressée par Y. Truskote, 3 exemplaires, deux en russe et un en latin, f. 36.

15. Partie orientale du district Yakoute, du même auteur, et distribution pareille au précédent (imprimé) f. 36. No. 15.

16. Carte du district Yakoute du pays Tchoukote, et du Kamtchatka, avec les terres limitrophes, aussi bien que d'une partie de l'Amérique du Nord et du Japon, dressée par Timothée *Pérévilow* (manuscrit) f. 37. No. 10.

17. Carte des lieux situés entre les promontoires Yakoute et Tchoukote et l'embouchure de l'Anadyr (manuscrit), f. 37.

18. Carte de la délimitation entre la Russie et la Chine d'après le traité de Golovine, dressée par les géomètres *Skobéltzine* et *Schuttilow* (manuscrit), 1689, f. 37. No. 12.

19. Carte de la province de Sibérie, communiquée par le commissaire *Kolytschew* en 1727, dressée par *Zinoviev*, d'après la description de *Skobéltzine* (manuscrit), f. 37. No. 14.

20. Mer Baïkale avec les parties des fleuves : Léna, Argoune, Sselenga et Angara et des districts environnants, dressée par *Trouskote* (imprimé), t. 37, No. 15.

21. Carte des bords de la mer, près l'embouchure de l'Olénék (manuscrit), f. 37. No. 16.

22. Carte du golfe maritime, depuis l'embouchure de l'Olénék jusqu'au golfe de Penjin, dressée par *Skobeltzine* et ses aides (manuscrit), f. 38. No. 17.

23. Carte du golfe maritime de l'île Ounalaschki, d'après un ordre du capit. *Léuschow*, dressée par le pilote *Schabanow* en 1769, f. 38. No. 18.

24. Carte des lieux situés sur les côtes de la mer Glaciale et le long des rives du fleuve Léna (manuscrit), f. 38. No. 19.

25. Carte des lieux appartenant aux rives de la Léna, depuis le lac Baïkal, dressée par *Béton* (manuscrit), f. 38. No. 20.

26. Carte d'un voyage vers les sources de la Léna (manuscrit), f. 38. No. 21.

27. Carte du fleuve Léna avec ses affluents, faite à la main par le professeur *Müller*, f. 38. No. 22.

28. Carte routière suivant les fleuves Ob et Léna jusqu'au Kamtchatka (manuscrit), f. 38. No. 23.

29. Carte des côtes de la mer depuis l'embouchure de l'Anadyr jusqu'à l'embouchure du Kolyne, aussi bien que celles des terres opposées, dressée en 1765 par le cosaque Nicolas *Dougline* (manuscrit), f. 38. No. 24.

30. Carte du fleuve Anadyr, des lieux adjacents, du pays Tchoukote et d'une partie de l'Amérique du Nord, 2 exemplaires; le plus récent est de 1765; c'est une copie exécutée au Collège de l'Amirauté, f. 38. No. 25.

31. Carte du fort (Ostrog) d'Anadyr et de la mer d'Anadyr (manuscrit), f. 38. No. 26.

32. Carte du pays, depuis l'embouchure du fleuve Oud jusqu'au fort Télémbinsk, f. 38. No. 27.

33. Carte du cours des fleuves Ochota et Koukhtha (manuscrit), f. 38, No. 28.

34. Carte du pays situé entre le fleuve Yénisseï et Kamtchatka (manuscrit), f. 39. No. 29.

35. Carte du cours du fleuve Bolschaïa, avec le fort Bolschérietchnoy, dressée par *Kozintzow* (manuscrit), f. 39. No. 30.

36. Carte des recherches d'une communication entre les fleuves Maya et Oud, dressée en 1761 par le caporal *Bobylew*, f. 39. No. 33.

37. Carte d'une voie navigable entre la v. de Iakoutsk et la Croix de Youdom, dressée sous l'inspection du cap. *Tchirikow* par le pilote *Dementiev* en 1737 (manuscrit), f. 39. No. 34.

38. Carte d'un voyage entrepris en 1741 pour la recherche des côtes occidentales de l'Amérique, dressée sous la direction du capit. Alexis *Tchirikow* (manuscrit), f. 39. No. 35.

39. Carte Mercator du pays entre Okhotsk, Lopatka et Tchoukotskoy-Noss, dressée d'après le journal du voyage de *Behring* en 1725 et un pareil journal de *Fedorow* en 1732, sous la direction de M. *Behring* en 1741 (manuscrit), f. 39. No. 36.

40. Carte du fl. Kamtchatka, de ses îles et des habitations voisines, depuis le fort Nijné-Kamtchatsk jusqu'au village Klutchevaïa. Dressée après un ordre du cap. *Krénitzyne* par le pilote Mich. *Kraschénnikow* en 1767 (manuscrit), f. 39. No. 38.

41. Carte Mercator d'une expédition maritime secrète, exécutée en 1768 et 1769 par le cap. *Krénitzyne* dans le but de déterminer les côtes du Kamtchatka et des îles voisines, dressée par le pilote Jacques *Schabanow* (manuscrit), f. 40. No. 39.

42 et 43. Cartes des autres parties de cette expédition, dressées par *Schabanow* (manuscrit), f. 40. No. 40 et 41.

44. Carte d'une expédition analogue en 1775, d'après le mémorial du cap. *Schmalow* (manuscrit), f. 40. No. 42.

45, 46, 47, 48. Travaux cartographiques du cap. *Schmalow* sur la voie entre Yakoutsk et Okhotsk; sur ces villes et les pays environnants; sur le Kamt-



chatka, sur le fl. Oulya et les îles de l'Amérique récemment découvertes, de 1768 à 1777, f. 41. Nos. 43-48.

49. Nouvelle carte des découvertes faites par les vaisseaux russes aux côtes inconnues de l'Amérique septentrionale avec les pays adjacents. 9 exemplaires de différentes éditions de l'an 1754 à 1773 (imprimé), f. 41. No. 50.

50. Six cartes imprimées par Buanche à Paris, 1752, des découvertes par les Russes dans les mers du Nord et du Sud, en 1747, f. 41. No. 52.

51. Carte des îles américaines, dressée par le marchand Pierre *Schischkine* en 1762 (manuscrit), f. 41. No. 54.

52. Carte des côtes maritimes depuis l'embouchure du fl. Léna jusqu'au fl. Oud, dressée par l'aspirant de marine Philippe *Vérthougow*, en 1767 (manuscrit), f. 42. No. 56.

53. Carte des îles dans l'Océan Oriental, visitées par le marchand *Schilow*, dressée en 1767 (manuscrit), f. 42. No. 57.

54. Carte des côtes maritimes, depuis le fl. Oulia jusqu'au point Tchoukote, dressée d'après les voyages entrepris dans les années 1764-1768 (manuscrit), f. 42. No. 52.

55. Carte d'un voyage secret, entrepris du fort Nije-Kovymsk jusqu'à la rivière Kréstovka et de là aux cinq îles maritimes nommées Medveju (des Ours), dressée en 1769 (manuscrit), f. 42. No. 60.

56. Carte des îles situées au delà du Kamtchatka, dressée par le pilote *Otchéredine*, signée par le cap. *Schmêlew* le 6 Septembre 1775 (manuscrit), f. 42. No. 62.

57. Carte Mercator des pays situés depuis le port d'Okhotsk jusqu'au fl. Ouda, et de là vers la Kourilskaja Lopatka, en achevant par le port Pétropavlovsk, dressée par Alexis *Kojévine* (manuscrit), f. 42. No. 63.

58. Plan de la ville d'Irkoutsik, communiqué en 1727 par le comte Ragouinski, dessiné par M. *Zinoviev* (manuscrit), f. 44. No. 69.

59. Le fort Oudinsk, de la même époque et origine (manuscrit), f. 44. No. 71.

60. Plan d'une nouvelle station commerciale construite près du fleuve Argoune, dans le district de Nertchinsk; de la même époque et origine (manuscrit), f. 44. No. 72.

61, 62, 63, 64. Quatre plans, dressés par MM. *Boborykine*, *Kouschelew*, et *Zinoviev*, de la nouvelle station commerciale à Kiakhta en 1729 (manuscrit), f. 44. Nos. 73, 74, 75.

65. Plan d'un fort nouvellement construit en 1729, pour défendre les magasins de Tchakoi, dressé par *Kouschelew* (manuscrit), f. 45. No. 77.

66. Projet de la construction du fort Nertchinsk, dressé par *Schwartz* en 1728 (manuscrit), f. 45. No. 78.

67. Deux projets des forts de Nertchinsk et Ssélinguinsk, de la même époque et origine (manuscrit), f. 45. No. 79.

68. Plan de l'ancien et du nouveau fort de Nertchinsk, avec cartes des rivières Schilka et Nertcha et des lieux environnants (manuscrit), f. 45. No. 80.

69. Carte d'une partie de la Sibérie, depuis le fleuve Anadyr jusqu'au fort de Saint-Elie, f. 45. No. 84.

70. Plan d'un établissement construit près les eaux minérales de Tourkine, f. 45, No. 87.

71. Carte précise d'une partie du Kamtchatka, des côtes d'Okhotsk, avec toutes les îles Kourilles, d'une partie du Japon, des côtes nord-est de l'Amérique avec toutes les îles Aléoutes, corrigée d'après les données les plus récentes, en 1781 (manuscrit), f. 45. No. 88.

72. Carte du fleuve Aldane depuis Yakoutsik jusqu'au port de Maya, dressée en 1735 (manuscrit), addition à la, f. 45. No. 95.

73. A plain Chart of the rivers Maya and Yudoma, communiquée par le lieut. *Waxel* (manuscrit), f. 95. No. 96.

74. Carte routière depuis la riv. Yénarantcha jusqu'au fort d'Ostrog, dressée

et communiquée en 1733 par *M. Skorniakow Pissarew* (manuscrit), f. 45. No. 97.

75. Carte routière depuis le fleuve Léna jusqu'au fleuve Amga, dressée par *M. Svistounow* (manuscrit), f. 45. No. 99.

76. Carte du cours des fleuves Yénisseï et Elagouy, depuis l'ancienne jusqu'à la nouvelle station d'hiver (manuscrit), f. 45. No. 100.

77. Carte du cours du fleuve Angara, depuis le fort Bratski jusqu'au village Karaptchansk (manuscrit), f. 45. No. 101.

78. Carte du district de Verkhnéoudinsk, dressée par *G. F. Muller* (manuscrit), f. 45. No. 102.

# GOUVERNEMENT DE TOBOLSK.

79. Carte descriptive de la province d'Yssète, dressée sous la direction du cap. *Jean Norossélow* en 1743 (manuscrit), f. 81. No. 1.

80. Carte de la province de Sibérie depuis l'avant-poste de l'ancien Outiage jusqu'au fleuve Irtych et la Sloboda de Tchernoloutzk, copiée par *V. Somow* en 1748 (manuscrit) f. 81. No. 2.

81. Carte routière depuis Tobolsk jusqu'au fort Oustkoutzk, dressée en 1735 par le géomètre *Tchekine* (manuscrit), f. 82. No. 6.

82. Carte du fleuve Irtych, parcourant la partie méridionale de la Sibérie et des possessions des Zungares, dressée par *I. Isléniew* en 1777 (imprimé), f. 82. No. 7.

83. Carte du parcours du fl. Irtych depuis le fort d'Omsk jusqu'à Tobolsk, dressée par *Isléniew* en 1780 (imprimé), f. 82. No. 8.

84. Onze feuilles de la carte du parcours du fl. Irtych depuis Tobolsk jusqu'au fort de Sémipalatinsk, dressée par *Muller* pendant l'expédition du Kamtehatka (manuscrit), f. 82. No. 9.

85. Cartes des lieux situés depuis les sources de la rivière Sosva jusqu'à l'Irtych (manuscrit), f. 82. No. 10.

86. Carte des steppes et pays situés près des sources des fleuves Ob, Toma et Irtych (manuscrit), f. 82. No. 11.

87. Carte des pays situés entre les fleuves Tobol et Angara (manuscrit), f. 82. No. 13.

88. Carte du pays situé entre les rivières Petchora et Neïpa (manuscrit), f. 83. No. 14.

89. Carte du pays situé entre Tobolsk et les sources de la riv. Mioussé (manuscrit) f. 83. No. 16.

90. Carte des pays situés entre les fl. Kama et Yénisseï (manuscrit), f. 83. No. 17.

91. Carte des pays situés sur le parcours des fleuves Tchara, Tchoulma, Ome et autres (manuscrit), f. 83. No. 19.

92. Carte du pays situé entre les forts de Tomsk et d'Oudine (manuscrit), f. 83. No. 20.

93. Dito entre les rivières Yourék et Dondina (manuscrit), f. 83. No. 21.

94. Carte routière à travers la steppe Barabine (manuscrit), f. 83. No. 22.

95. Carte des lieux entre la rivière Soswa et Neïpa (manuscrit), f. 83. No. 23.

96. Carte routière depuis la ville de Mangazeï (Touroukhansk) en suivant le fleuve Yénisseï jusqu'à l'Océan du Nord, dressée en 1738 sous la direction de *Th. Minine* (manuscrit), f. 83. No. 24.

97. Carte du pays de tout le parcours du fleuve Ob et de ceux situés sur le long de la rivière Tase (manuscrit), f. 84. No. 25.

98. Carte des lieux situés entre le fort Tchewsk et le fleuve Irtych, f. 84. No. 26.

99. Carte du parcours de la rivière Wagay, et des lieux situés dans son voisinage (manuscrit), f. 84. No. 27.

100. Carte du parcours de la rivière Khatancha (Khotangua) ou Tourgouska inférieure, 5 feuilles (manuscrit), f. 84. No. 28.

101. Plan des mines d'or et d'argent à Ziméyew (manuscrit), f. 85. No. 30.

102. Plan de la distance entre Tobolsk et le fort d'Okhotsk, avec des notes sur les différentes déviations du compas, et une indication des lieux habités par les Ostiaks, Toungousses et autres peuplades. Dressé en 1725 et 1726, lors du voyage en Sibérie du capitaine *Behring* (manuscrit), f. 85. No. 32.

103. Carte, communiquée en 1732 par le capitaine *Behring*, d'une description des côtes de la Sibérie et des lieux qu'il a parcourus de Tobolsk jusqu'à Kamtchatka (manuscrit), f. 85. No. 33.

104. Carte de la Sibérie et du pays Kontaïchien, dressée par le major des gardes Likharew, d'après le témoignage des habitants (manuscrit), trois exempl., f. 85. No. 34.

105. Trois exemplaires d'une carte des lieux de campement des Kalmouks dans les possessions du Kontaïcha, avec une partie de l'empire de Chine et de la horde des Kasaks, dressée en 1722 et 1723 par le capitaine d'artillerie *Ounkowskoi*, lors de son séjour chez le Kontaïcha, f. 85.

106. Plan des pays situés sur les confins des possessions des Chinois et du Kontaïcha, dressé par le voyévode de Yakoutsok *Poloujektow*, et communiqué par le vice-gouverneur de Tobolsk *Boltine* en 1730 (manuscrit), f. 85. No. 37.

107. Trois feuilles d'une carte du cours du fleuve Irtysch près de Tobolsk et à travers le lac Norsaïssan, avec l'indication des affluents de ce fleuve, dressée par le géomètre *Tchitchagow* sous la direction du major *Likharew* (manuscrit), f. 86. No. 37.

108. Dito d'une partie de la frontière de la Russie avec l'Empire de Chine. Communiquée par le gouverneur de Sibérie Pleschtcheyew en 1733 (manuscrit), f. 83. No. 38.

109. Carte des habitations de sujets russes le long des frontières des possessions du Kontaïcha ou Zungares. Communiquée par le gouverneur de Sibérie en 1738 (manuscrit), f. 86. No. 39.

110. Carte de différentes mines et usines, situées entre les fleuves Ob et Irtysch et au-delà d'Ob (manuscrit), f. 86. No. 41.

#### GOUVERNEMENT DE TOMSK.

111. Carte des districts de Tomsk, de Krasnoyarsk et de Kouznetzk, aussi bien que des mines et usines de Kolyvano-Voskressensk (manuscrit), f. 87. No. 1.

112. Carte complète des districts de Tomsk et de Kouznetzk, et particulièrement des usines de Kolyvano-Voskressensk (manuscrit), f. 87. No. 2.

113. Plan d'un volcan près la ville de Kouznetzk, f. 81. No. 5.

#### PLANIGLOBES IMPRIMÉS.

1°. Tableau de la sphère céleste en chinois sur 3 feuilles, f. 11. No. 2.

2°. Cinq tableaux du globe terrestre en arabe, f. 11. No. 5.

#### CARTES FRONTIÈRES.

##### OU DES PAYS LIMITOPHES A L'EMPIRE DE RUSSIE.

##### 1. Chine.

Trois cartes frontières des Empires de la Russie et de celui de la Chine, transmises au collège des affaires étrangères par le gouverneur de la Sibérie *Soymonow* en 1758 et en 1762 (manuscrit), f. 95. No. 1.

2. *Perse.*

1°. Deux cartes indiquant comment doivent être les frontières de la Perse. Dessin transmis au C. D. A. E. en 1726 (manuscrit), f. 96. No. 1.

2°. Frontières des Empires de Russie, Perse et Turquie. Dessin envoyé en 1725 par le prince de Géorgie *Vakhtangue* (manuscrit), f. 96. No. 2.

3°. Copie d'une carte de la frontière de Perse, dressée de mémoire, sur deux feuilles (manuscrit), f. 96. No. 3.

## CARTES DES PAYS ÉTRANGERS.

1. *Inde Orientale.*

Hindostan, de *T. Keim* V. F. R. I. 1782 (imprimé) sur deux feuilles, f. 105.

2. *Chine.*

1. Carte des îles du Japon dressée par *Bellin* en 1735, f. 106.

2. Carte donnant les contours du Japon, de la Corée, de l'île d'Esso et du Kamtchatka (manuscrit), f. 106.

3. Trente cartes de la Chine, de différentes dimensions; légendes chinoises; quelques-unes d'entre elles portent des notes faites en russe (manuscrit), f. 106.

4. Dessin d'une église nouvellement construite à Pékin. Les dimensions sont rendues par un cordon, qui porte des marques en papier avec inscriptions des longueurs et largeurs, etc., etc. Ce dessin a été envoyé de Chine en 1732. f. 106. No. 4.

3. *Perse.*

1. Provinciarum Persicarum Kilaniae, nempe Chirvaniae, Dagestaniae Geographica tabula. Auct. Homanno. Norimbergae, f. 109.

2. Plan de Kandahar, transmis par le président *Jean Kalouschkine* en date d'Ispahan, du 17 mai 1783 (manuscrit), f. 109. No. 2.

3. Carte du Hilan et des autres provinces situées sur les côtes de la Caspienne. Transmis par le lieutenant-général *Lévaschow* en 1729 (manuscrit), f. 109. No. 3.

4. *Tartarie.*

1. Carta partis Asiae, quam ob varia viarum pericula et immensos itineris labores nemini peregrinatorum numsq. contigit oculis videre. Auct. Basilis Batatzi. Londini 1732 cum explicatione (en latin et grec). Elle représente les peuples habitant aux environs des mers Caspienne et Aral, etc., les Kal-mouks, Karakalpaks, Touke-tans, Ousbeks, Kirghizes, etc., etc. (imprimé), f. 110 additionnelle.

2. Carte nouvelle de la Grande-Tartarie par M. Witz. Amsterdam, sans date, f. 110.

3. Carte de la horde Kirghize-Kaissaque centrale, en tatar (manuscrit), f. 110. No. 3.

4. Dessin exécuté d'après les témoignages oculaires sur Khiva par le directeur de la douane d'Orenbourg, M. *Velitchko* (manuscrit), f. 110. No. 4.

5. Plan de la cité de Khiva (manuscrit), f. 110.

6. Carte des pays des Karakalpaks et Ousbeks, situés sur les côtes orientales de la mer Caspienne, autour de la mer d'Aral, avec des indications des lieux très détaillées (manuscrit), f. 110. Voyez le titre détaillé à la page 1<sup>re</sup> (4 et 5).

5. *Zungarie.*

Carte de la Zungarie, dressée en 1724 par le capitaine Ounkovskoï, ambassadeur de Russie auprès du Khan Zungar. (Extraite du dossier de l'an 1724. Zungarie, No. 1). Voyez p. 8, 106.

## CARTES MARITIMES.

Carte Mercator, dressée par le négociant d'Oustiongue *Nikita Schalacukhow*, de son voyage entrepris en 1762 dans le but de découvrir une nouvelle voie à travers l'océan Arctique. No. 7.

APPENDIX C.—*List of Officers of the International Congress at St. Petersburg, 1876.*

President of the Congress	.. ..	M. Grigorieff (R.) *
Presidents of Sections :—		
1. Siberia .. ..	.. ..	M. Vassilieff (R.).
2. Central Asia .. ..	.. ..	M. Ch. Schéfer (F.).
3. Caucasus .. ..	.. ..	M. Gamazoff (R.).
4. Trans-Caucasia .. ..	.. ..	M. Patkanoff (R.).
5. Extreme East .. ..	.. ..	M. de Rosny (F.).
6. India, &c. .. ..	.. ..	M. Kern (H.).
7. Turkey .. ..	.. ..	His Excellency Almed Vélyk (T.).
8. Archaeology .. ..	.. ..	M. Oppert (F.).
9. Religious Systems .. ..	.. ..	Mr. Douglas (E.), British Museum.
Vice-Presidents of Sections :—		
1. Siberia .. ..	.. ..	{ M. Slovtsoff (R.).
		{ M. Neumann (R.).
2. Central Asia .. ..	.. ..	{ M. de Goeje (H.).
		{ M. Veliaminoff-Zernoff (R.).
3. Caucasus .. ..	.. ..	{ Mr. R. Cust, F.R.G.S. (E.).
		{ M. Berger (R.).
4. Trans-Caucasia .. ..	.. ..	{ Mr. F. Clarke, F.R.G.S. (E.).
		{ Mr. E. Eastwick, C.B., F.R.G.S. (E.).
5. Extreme East .. ..	.. ..	{ M. Zakharoff (R.).
		{ M. Lagus (R.).
6. India .. ..	.. ..	{ M. Sachau (G.).
		{ M. Kosowicz (R.).
7. Turkey .. ..	.. ..	{ Mr. Wright (E.), Cambridge.
		{ M. Mehren (D.).
8. Archaeology .. ..	.. ..	{ M. Tiesenhausen (G.).
		{ M. Stickel (G.).
9. Religious Systems .. ..	.. ..	{ M. de Gubernatis (I.).
		{ Mr. Chenery (E.), Oxford.
General Secretary .. ..	.. ..	Baron Osten-Sacken (R.).
Assistant Secretary .. ..	.. ..	Baron Rosen (R.).
		{ M. Derenbourg (F.).
		{ Mr. D. Morgan, F.R.G.S. (E.).
Secretaries of Congress .. ..	.. ..	{ M. Jeannidi (Gr.).
		{ M. Smirnoff (R.).
		{ M. Tcharikoff (R.).
		{ M. Terentieff (R.).
Treasurer .. ..	.. ..	M. Giurgass (R.).

\* The letters (R.), (G.), &c., after the name denote the country of which the individual is the representative. (R.) Russia, (F.) France, (G.) Germany, (Gr.) Greece, (I.) Italy, (H.) Holland, (D.) Denmark, (T.) Turkey.

## 2. *The Tchoukot Expedition in 1868.* By DR. CARL NEUMANN.

[Translated and communicated by Capt. CLARKE.]

THE whole of the north-east of Siberia is peopled by three different tribes, called by the common name of the Tchoukchis. These three tribes are: (1) The Reindeer Tchoukchis; (2) The Aigwanis, who live along the Tchoukchi promontory; and (3) The Nammols, to the east of Cape Cook. It was to the first-mentioned tribe that the expedition, of which Dr. Neumann was a member, was undertaken in 1868. This tribe occupies the territory between Behring Strait and the Kolym on one side, and between the Glacial Sea and the River Anadyr on the other. The climate of this region is so severe, that there are few nights in the year in which it does not freeze. Under such unfavourable conditions, vegetation is very scanty; it consists mostly of lichens.

The animals met with are the reindeer, the black bear, and certain birds, which migrate here for a short time in spring, and enliven with their song the mournful solitude of these vast wastes. There are no precious metals, nothing to attract man. The Tchoukchis, however, are not the first inhabitants. The Yakuts emigrated from the Baikal to this country, probably in the time of Chengiz Khan.

The author believes with Miller that the Tchoukchis came from the other side of Behring Strait. In the country, new to them, they found settlements of Koriaks, with whom they waged sanguinary conflicts until the year 1740.

At the present time the Tchoukchis number about 3000 souls.

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On the 15th of August, 1868, says Dr. Neumann, we left Irkutsk, and arrived at Yakutsk on the 22nd of September. We passed five weeks at Yakutsk in order to complete the equipment of our expedition, which started on the 30th of October, and on the 1st of November reached Aldan (in Djeli). Djeli is about 140 miles from Yakutsk. On the 7th of November we left Aldan, with an escort of two Cossacks of the Yakutsk Regiment, and five Yakuts as guides.

From Aldan to the Verkhoi Range is reckoned 145 miles, the way lying through a district entirely uninhabited. For more than half the distance the road trends along the Valley of the Tukulan, which river, taking its rise in a small lake in the mountains some miles from the place where the road intersects the range, falls into the Aldan from the right bank. The Tukulan has the characteristics of a mountain-stream; it forces its way through narrow defiles, overflows its banks in the spring and in rainy weather, uprooting in its impetuous course the poplars and larches which have stood for centuries. The fallen trees make travelling difficult, and greatly fatigue the already exhausted horses, whose only food consists of the leaves of trees, and some occasional blades of wretched grass, from the surface of which the snow has been previously scraped away with their hoofs. On this road it was that we made our first acquaintance with the so-called "kitchens," small cabins or huts, generally of an hexagonal form, with a slightly convex roof. Each side of the hexagon is some 7 feet in length, and the roof is covered with a layer of a few inches of earth, space being left for the exit of the smoke from the fireplace. These cabins are constructed along the road at intervals of 25 to 35 miles, at those points where there happens to be fuel and grass.

Wretched as they are, the half-frozen traveller in this dreary waste hails with delight the appearance in the distance of the smoke and sparks issuing from the roof, and with a feeling of special satisfaction finds on arrival the small fire kindled by the Yakut guide sent on in advance. It is impossible to understand why the Yakut traders who traverse this district every year

do not erect something better—for instance, *yurtas*,\* which are in every way superior to these wretched hovels, where the smoke hangs in a thick cloud, causing the eyes to smart, and into which the wind finds its way at pleasure, and threatens each minute to chill one to the bone—to say nothing of having to throw out the snow which falls through the smoke aperture. Is it that use is second nature?

On the 11th of November we reached the kitchen at Kurum-Hopchagai, about 45 miles from the pass over the range, and there had to wait for twenty-four hours, as we received information from some roving Tunguzes that there was no chance of our being able to cross the range, owing to the strong wind, but that in two or three days there was every probability that the wind would subside. The weather at Kurum-Hopchagai was so bad, that it was impossible to make observations for determining the latitude.

On the 14th of November we reached the last kitchen on this side of the Cis-Anna Range. The forecast of the Tunguzes proved correct; the wind subsided, and we crossed the mountains. The whole of the little district of Teriah-Yurea is treeless. I determined the position of this place in spite of the thermometer registering  $26^{\circ}$  R. below zero. The pass over the Verkhoi Range is very difficult, and occupies about seven hours, the southern slopes presenting greater difficulties than the northern. The highest point of the ascent was, according to the registration of the barometer, 4700 feet above the level of the sea. On the summit stands a cross, upon which the passing Yakut hangs a lock of his horse's mane, or a rag, as a thank-offering for his safe passage of the mountains. On either side of the highest point of the road the mountains rise to a further height of 700 feet, so that the range attains an elevation of 5400 feet. Here is also the lake from which the River Keh-Yuriah takes its rise. This river, at a distance of 12 miles from its source, unites with another mountain-stream, the Teriah-Yuriah. The two streams form the Sartan, which, on being joined 6 miles above the town of Verkhoi-yansk by the Dulalahoh, changes its name to the Yana.

On the 24th of November we reached Verkhoi-yansk by the post-road. On the way thither I took some observations, but, with the thermometer at  $41^{\circ}$  R. below zero, it was a matter of great difficulty, and it is impossible to ascribe great accuracy to them under the circumstances. It will be quite sufficient to mention that, after previously warming the instrument at the fire, less than five minutes in the open air suffices to congeal the lubricant, and prevent the axis and screws of the instrument from working; to say nothing of the risk run of having the fingers frozen by contact with the instrument, as the thickest gloves afford no protection.

The climate had changed ever since we had passed the mountains. For three weeks the thermometer fell below  $40^{\circ}$  R., and was even as low as  $48^{\circ}$  R. below zero. The lowest observed temperature during the year 1869 at Verkhoi-yansk was  $52^{\circ} 2$  R. below zero.

At Verkhoi-yansk we heard of the mammoth found by a Tunguz in the River Homos-Yurea, which falls into the sea between the Indignka and the Alazya.

On the 5th of December we left Verkhoi-yansk, and reached Tabalah on the 10th, where we remained four days. Here we changed our mode of conveyance from horses to reindeer-sledges.

Leaving Tabalah on the 14th, we passed through the districts of Tostah (26 miles), and Tiugun-Erestiah (50 miles), and thence through the defile of the River Habarotka, which falls into the Dogdo. The Dogdo in its turn falls into the Adicha, which also receives the waters of the Tostah. The Adicha flows into the Yana, not far from Tabalah. Along all these rivers

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\* Tents of felt. —TRANSLATOR.

there are roads. The River Habarofka at this point flows between high mountains of black and yellow schist.

The water-parting between the Yana and the Indigirka consists of a spur from the Verkhoiansk Range, the Tass-Hayatah, which stretches nearly due north and south between those rivers. (Here rise the Dogdo and Seleniah.) There is another similar spur from the same range which forms the parting between the Indigirka and the Alazeya. The so-called Alazeya Range is also parallel to the other two, and separates the waters of the Alazeya from the western affluents of the Kolym. All these chains are much lower and less abrupt than the Verkhoiansk Range, and near the Ledovit Sea take the form of low hills. The Alazeya Range forms the boundary between the districts of Verkhoiansk and Kolym.

On the 16th of January we arrived at Srednie-Kolymsk, a town of fifty houses, lying on both banks of the River Ankudin, which enters the River Kolym close to the town from the left side. A detachment of forty Cossacks is stationed in the town.

Here we met the Tchoukchis for the first time. In 1866, owing to their pasturage failing, they had petitioned the Russians to be allowed to transfer their habitations from the right to the left bank of the Kolym: to the so-called Great Tundra, a district bordered on the north by the Ledovit Sea, on the east by the Kolym, on the west by the Indigirka. On the south its frontier may be approximately stated as the River Fedotika, which flows into the Kolym from its left side in about 67° N. lat.

The Tchoukchis now once more renewed their request, which was granted, and some fifty migrated at once. The impression produced by these people was exceedingly agreeable. They are of high stature, well proportioned, and with a type of face neither Mongol nor Tartar. In answer to our inquiries as to the present place of abode of their chief, Amraoorgin, they replied that he was probably at the sources of the Great Anyui and Chaun rivers.

On the 12th or March we left Srednie-Kolymsk in our reindeer-sledges, and passing through Butalah, Sigdy-ltar, Olbut, and Pomaskino, reached Kresta, a distance of 185 miles. From Kresta we proceeded with dogs to Nijne-Kolymsk, about 130 miles. The road runs along a river, through the villages of Omolonska and Timkino. This distance of 130 miles is usually traversed in two days.

We arrived at Nijne-Kolymsk on the 17th of March, when the fair was at its height. We remained here five days. The barter consists of skins for tobacco. The town is nothing more than a few huts; the old fort is in ruins.

On the 23rd of March we left for the Anyui Fort, a distance of 170 miles. The road at first follows the Kolym, and afterwards the River Little, or Dry, Anyui; its banks, once inhabited by the Yukagirs, are now depopulated, as the wild reindeer, man's only means of existence in these parts, no longer come down to it.

On the 25th of March we reached the Anyui Fort. After we had been there a few days, we were visited by Amraoorgin, chief of the Tchoukchis, or, as he is sometimes called, Taen (in the Takut language this is equivalent to lord or master), a man about 56 years of age.

Here we were introduced for the first time to a Tchoukchi *cuisine*. The repast consisted of frozen fish, frozen reindeer-marrow, 'smoked reindeer-tongues, and boiled reindeer-flesh, winding up with frozen pigeon, a favourite dish of the Tchoukchis.

When dinner was over, we proceeded to witness the games of the women. They sang songs, if you can call by such name the discordant noises we heard. Their dances, in which only the women take part, are very original; they gesticulate with their arms alone, keep the feet almost still, mimicking and making grimaces the while.



On the 4th of April we made a start. This day may be considered the commencement of the Tchoukot Expedition, as it was then that we began to wander amid the Tchoukchis. Our party consisted of four Russians, three Cossacks, and Amraorgin and his suite. We proceeded in reindeer-sledges about 8 miles up the Anyui to the mouth of the River Kobelef Liarhan, which flows into the Anyui from the left side, and then up that river for 2 miles. On the 5th we proceeded about 20 miles up the Liarhan, and passed the night at the foot of a small mountain-chain. Next day we crossed this range, and descended to the Kamenni River (an affluent of the Orlofka), which falls into the Great Anyui. These mountains consist of red porphyry and black slate. Their height is about 2000 feet, and in them are found quantities of wild sheep (*Ovis nivicola*), an animal met with throughout the Tchoukot country as far as the Ledovit Sea. Hunting them is rather dangerous, as they are very savage when wounded. Their flesh is sweet, fat, and not unlike venison.

On the 7th we debouched on the Orlofka, and proceeding along it for 13 miles, came to the River Berezofka, which falls into the Great Anyui. We followed its course as far as its mouth (12 miles).

On the 8th we marched 25 miles up the River Anyui. On the 9th we parted from this river, and commenced the ascent of the mountains. It was not steep, but rather long. We completed about 28 miles this day, and 33 miles on the next, when we halted on the upper course of the river.

On the 11th we only marched 10 miles, as the quantities of large stones encumbering the river made our progress difficult.

On the 12th and 13th, after a journey of 40 miles, we reached Amraorgin's residence, making a total distance of 200 miles completed in ten days. On this day we shot some partridge of a remarkable kind (*Lagopus alpinus*), which we had only seen once before at Tabalakh, and the existence of which is disputed by Pallas.

The place where Amraorgin has wintered for several years in succession is in  $66^{\circ} 35' 2''$  N. lat., and  $166^{\circ} 22'$  E. of Greenwich, and about 2000 feet above the level of the sea. It consists of a rather broad plateau, about 10 miles across, surrounded on all sides with high mountains. Vegetation is sparse, but, what there is, is well-leaved. Here we became acquainted with the home-life of the Tchoukchis. Amraorgin has three wives. By his eldest wife, Anna, a poor girl of the Churan tribe, who saved his life from a black bear, he has had one son and three daughters. His second wife is Maria, by whom he has one daughter. These ladies are no longer young. His third wife is a young and pretty woman, to whose parents he paid a whole herd of reindeer, in order to obtain her.

The Tchoukchis are very proud of their children, and spoil them.

On the 23rd of April we were again *en route*. Ascending a small stream, we reached on the 26th the source of the River Tenncke, which falls into the En-moa,\* one of the tributaries of the Anadyr. The other sources of the Anadyr are the Kim-gim (Red or Great Peledon) and the Anetva (Little Peledon).

The geological formation of the low range of mountains separating the waters of the Great Anyui from the affluents of the Anadyr is porphyry, diorite, yellow and black slate, and occasionally granite. Trees are scarce, and are only found on the south side—larches, poplars, and low willows. From this point we intended to reach Kolnchen Bay, and thence East Cape; but were dissuaded from doing so by the Tchoukchis, on the grounds that there was no grass for the reindeer. We therefore determined to move southward.

About the 20th of June we were much plagued with gnats, which literally

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\* Called Meehkeroba by the inhabitants of the villages of the Anadyr.

darkened the air, so that the sun could not be seen. With them appeared spiders, the *bête-noir* of the reindeer. They lay their eggs under the skin of the animal, and the larvæ, when hatched, torment them severely. In July, the summer season, the thermometer seldom rose above 13° R., and seldom fell below 0°.

We also met with another tribe of sedentary Tchoukchis. In appearance they are very like the Reindeer-Tchoukchis; but their language is entirely different. The Reindeer-Tchoukchis call them Ang-kali, which means "near the sea." They do not breed the reindeer, but live on fish, walrus, and seals. But as their clothing consists of reindeer-skins, they are more or less dependent on the Reindeer-Tchoukchis, by whom they are regarded as inferior.

I will here remark, *à propos*, that Rink, the Danish savant, formerly the Director of the Danish Colonies in Greenland, and a gentleman thoroughly acquainted with the life and language of the Esquimaux, sent us a book of tales and traditions of that people, and, supposing them to be of the same descent, asked us to find out and communicate to him whether the same tales exist among the sedentary Tchoukchis. But I can confidently assert that with neither the one nor the other tribe of Tchoukchis does anything of the sort exist. One of their few traditions is that their forefathers came at one time from the other side of Behring Strait. Another is one of the creation of the world. It was narrated by the sedentary Tchoukchis as follows:—In the beginning one pair of human beings was created, from whom sprung all nations. Each of these occupied himself with his handicraft according to his mission and peculiarities.

On the 1st of August we at length saw the sea. This was Kanchelon Bay. The small and rocky islet in it is called Pericheff. The sea was only 20 miles distant, but it took us eighteen days to reach it, owing to the heavy rain and the impediments of small rivers, which we were unable to cross, there being no wood to make boats.

On the 19th of August we reached the high steep bank (about 280') at the mouth of a small river, where we pitched our camp in lat. 64° 43' 23" N. and 114° 53' 55" E. of Greenwich. We remained until the 3rd of September, by which date the last of the birds of passage had taken his departure—the grebe (*Cepphus arcticus* of Pallas).

On our return journey we did not take the route along the bank of the Anadyr, but one about 65 miles to the north of it. On the 16th of September, snow beginning to fall, we once more took to our sledges; and on the 19th of October reached the Anadyr, and the first Russian houses. In these houses, however, there were no inhabitants; they serve only as summer residences for the inhabitants of the villages of the Anadyr at the time when the fish ascend the river, and when the wild reindeer cross it. Reindeer proceed in the summer in vast herds to the Ledovit Sea, to escape their tormentors, the gnat and the spider, and in the autumn, towards the end of August, return to their pastures. During their autumn wanderings no obstacles stop them, no rivers detain them. In thousands and tens of thousands they swim across even such rivers as the Anadyr, 2000 yards in breadth. Then commences the hunting season.

On the 8th of November I left for Nijne-Kolymsk. The road lay across the Anadyr for 10 miles, and then for seven days up the River Podymnoi to its source. Then across the mountains, the ascent of which was so steep that we only accomplished 9 miles in two days.

The Anadyr Range is a continuation of the Verkhoyansk, but much lower. It does not exceed 5000 feet in height. In nearly all the maps it is wrongly placed. It is there shown as an off-shoot of the Stanovy Range, with which it has nothing in common. The Anadyr Range forms the water-parting between the northern affluents of the Anadyr and the rivers flowing into the Ledovit

Sea. In the place where I crossed it in the winter of 1869, one of its spurs separates the waters of its eastern affluents, *e.g.* Sibachia, Spuskovaya, and Dressvianaya, from its northern affluents, *e.g.* the Podzemnoi. If we take a look at the course of the Anadyr on the map, and find the place where this river bends abruptly from north to east, my words will be perfectly plain. I arrived at Nijne-Kolymsk on the 2nd of December, having accomplished 800 miles in twenty-four days.

During my stay at Nijne-Kolymsk, I determined the longitude of the place by a series of lunar distances to be  $160^{\circ} 56' 3''$ , and its latitude  $63^{\circ} 31' 56''$ , which agrees very closely with Wrangel's observations, viz.  $160^{\circ} 56' 34''$  and  $68^{\circ} 31' 53''$  respectively.

### 3. *A Voyage to Uzbekistan in 1671-72.\** (From documents preserved in the Archives of the Ministry of Foreign Affairs at Moscow.)

[ABSTRACT by Capt. CLARKE, R.A.]

In the year 1669 Boris Andréyéwitch Pazukhin was sent by the Tsar Alexis Mikhailowitch (father of Peter the Great) to the khans of Khiva, Bokhara, and Balkh. He left Moscow on the 30th of June, 1669, provided with letters from the Tsar, and presents for the different khans. Descending the Rivers Moskwa and Oka, he arrived on the 20th of July at Kazan, from which place he passed down the Volga to Astrakhan, after being joined by an escort of *Streltsi* (the soldiers of that epoch). In consequence of the delay of the escort, however, it was not until August of the following year that Astrakhan was reached.

In the seventeenth century, according to Pazukhin, there were three routes into Uzbekistan: (1) Across the Caspian to Astrabad, and thence by Meshhed and Merv to Bokhara—a journey of fourteen weeks;† (2) From the Port of Karagan on the Mangyshlak Peninsula to Khiva. From Karagan to Khiva was only four weeks' journey, but the duration of the passage from Astrakhan to Karagan depended on the force and direction of the wind. This was the shortest route, but the most dangerous, both on account of the storms, which were of constant occurrence, particularly in autumn, and also owing to the aggressive character of the nomad Turkoman tribes inhabiting Mangyshlak. (3) Lastly, Khiva could be reached by passing along the northern side of the Caspian. This was the route selected at the recommendation of the Voyvod of Astrakhan, Prince Prosorovsky, as being the least dangerous. But it was impossible to proceed without guides and an escort, and at the order of the Tsar, transmitted by the Voyvod, the Calmuck Khan, Daichine Taisha, encamped on the banks of the Úral, placed six of his subjects at the disposition of the envoy.

Pazukhin purchased at Astrakhan nineteen camels, and left on the 10th of March, 1671, for Khiva.

After fourteen days' march he arrived on the River Úral, at the camp of the Calmucks, who, like other nomads, were preparing at this season to move to more northerly regions, from which they return in the autumn.

On the 1st of April, Pazukhin quitted the Calmuck camp, and, after halting for a day on the 31st of the same month on the banks of the River Saniz, at the encampment of the tribe (*ulus*) of Nazar Mahmoud, grandson of Daichine

\* Communicated and read by Mons. Nicholas Tcharikoff, at the Congress of Orientalists at St. Petersburg in 1876.

† A day's journey (*dnishtché*) = 20 miles.

Taisha, the Russian envoy arrived on the 14th of May before Kata, the first town in Khivan territory,\* two days' journey from the capital.

The Khan of Khiva, Navsha Mambet Khan, had already sent to this town to meet Pazukhin *Khoudaberdei*, who acted as commissary to all foreign missions coming to Khiva.

On the 16th of May, Khoudaberdei, accompanied by some soldiers, Uzbeks, and others, met Pazukhin and his suite a few miles from the town. Khoudaberdei greeted the envoy in the name of the Khan, and presented on behalf of his master a richly-caparisoned horse. He conducted him to the village of Djanarobei, where tents were prepared for the travellers, and afterwards proceeded to announce the arrival of the mission to the Khan.

Two days later, Pazukhin and his suite made their entry into Khiva mounted on magnificent horses provided by the Khan, and accompanied by two *Yussauls* (persons of rank), a hundred Uzbeks, and large numbers of citizens. The envoy and his suite were lodged in the old palace of the Khan.

The audience took place on the 21st of May. The Khan received Pazukhin seated on carpets spread over the floor of the "golden room," which was situated in the middle of his garden. Near the Khan were seated twenty-four *Atulyki*, and other personages of the Court; in front of the door were *Yussauls* with long sticks, and upwards of a hundred Uzbeks. The Khan took from Pazukhin's hand the letter of which he was the bearer, inquired after the health of the Tsar, and listened to the envoy's address.

Afterwards various eatables were handed round on silver plates, with water and milk (probably *Kumis*) in golden goblets. When the repast was over, Pazukhin returned to his domicile.

The presents which Pazukhin had brought for the Khan, as well as those which he distributed to the persons of the Court, were received with evident feelings of satisfaction.

On the 24th of the same month Pazukhin was again invited to the Khan's palace, and, after a similar repast, the Khan, at Pazukhin's solicitation, gave him permission to proceed to Bokhara. At this audience the question of liberating the captive Russians in Khiva and the surrounding countries was discussed at length between the Khan and the envoy. The former ultimately promised that the traffic in Russian prisoners should cease, that they should no longer be sold in distant countries, and, while awaiting the Tsar's answer relative to the purchase of the prisoners, agreed that a certain number of Russians should be sent gratuitously to Moscow with Pazukhin when the latter again passed through Khiva on his return to Russia.

Leaving Khiva on the 3rd of June, Pazukhin arrived on the same day at the town of Khanki—all the towns mentioned by Pazukhin still exist—and the next day at Azarist (Khazar-asp), and after crossing the Amu, reached the frontier of Bokhara. After a march of eight days across the desert, the Russian caravan halted not far from the first town in Bokhara—Kara-Kol.

The Dar-aga of the place, a functionary charged with the administration of justice in commercial matters, and with receiving custom and other dues, received Pazukhin in the same manner as the Khivan commissary had done. The Dar-aga informed Pazukhin that the Khan of Bokhara, Abdul Aziz (or Abda Aziz) had left for the frontier with his troops, in order to give battle to the Khan of Balkh; that he was at the time in the town of Karshakh, and would be apprised of the arrival of the Russian mission.

On the 23rd of June the Russian envoy entered Bokhara, where he was received by Tash-Boulat Bii, to whom the Khan had entrusted the care of the capital during his absence.

It was not until December that Abdul-Aziz returned to Bokhara. Pazukhin

\* The precise halting-place was Koulabia, not far from Kata.

had meanwhile studied the political and economical condition of the Khanates of Uzbekistan, and gives the following particulars with regard to their army and finances. The army of Bokhara, including the auxiliary troops furnished by the Karakalpaks, comprised upwards of 150,000 men. The army of the Khan of Balkh was less than half the size; while the army of the Khan of Khiva barely numbered 30,000 horsemen. In the event of war, not only the troops, but all the Khivan people—agriculturists, merchants, &c., took part, in the hope of obtaining booty. The mode of warfare which obtained with the Khivans was the same as with the Calmucks, and neither at Balkh nor Bokhara was there at that time any infantry or artillery. The Khans were not rich, as they had distributed nearly all their territory among their dependents instead of pay. The revenue was derived from a house-tax and custom-dues.

Throughout Uzbekistan cereals were sown and irrigation was indispensable. With regard to silk, Bokhara did not produce sufficient for its requirements, and in consequence exported nothing. Khiva produced annually about 16 tons of raw silk, which sold at about a rouble a pound.

The merchandise in greatest demand for the Khivan market included cloth, furs, skins, vessels of various kinds, pins and needles.

Soon after the return of the Khan to Bokhara, Pazukhin was received at the palace. The court of Abdul Aziz appeared much more extensive and brilliant than that of Navsha-Mambet. The Khan was surrounded by the Khosi—his relatives, and by more than 100 other personages of the court. On entering the reception-hall, Pazukhin was supported on the right by the *Divan-Begi* Mahmet-Mazir-Bei, and on the left by the chief magistrate, Datakhbek.

After Pazukhin had delivered the Tsar's letter to the Khan and read his address, the Khan invited him to be seated, and inquired about his journey, and about the court of the Tsar; and when Pazukhin complained of the molestation to which travellers to Bokhara were subjected, Abdul Aziz promised to write to the Khan of Khiva, with a view to his taking measures for protecting travellers from the nomads.

According to Oriental custom, Pazukhin had to make numerous presents, particularly to the Khosi, who told him, amongst other matters, that it was they who had protected the Russians at Bokhara during the civil wars; and they begged him, in the event of any disturbance in the capital, to come to them for shelter, as they would not plunder or give up those under their protection. Pazukhin had, however, no cause for seeking this protection, as Bokhara was tranquil during the whole period of his stay.

The subject which detained Pazukhin at Bokhara was the freedom of the Russian prisoners. At this epoch the traffic in Russian captives was systematically organised in Uzbekistan. The Calmucks and the Bashkirs made incursions into Russian territory, and carried off the inhabitants of the villages, the streltsi, and the merchants who came in their way. Khivan traders came to the Calmuck and Bashkir camps and purchased the captives. They were afterwards again sold in Bokhara, Persia, and elsewhere. The price of a slave at Khiva was at that time about 40 to 50 roubles. Pazukhin purchased the release of several Russian captives.

After a final audience with the Khan, Pazukhin quitted Bokhara.

Pazukhin had received instructions to visit the Khan of Balkh; but the war then raging between that country and Bokhara, rendered the project impracticable. Pazukhin, however, decided to send his interpreter, who reached the town safely, presented his letter, and on the 23rd of May, 1671, returned with one addressed to the Envoy by the Khan *Souphiane-Kouli-Khan*.

Pazukhin did not return to Russia by way of Khiva and the Calmuck

territory, but took the road to the south of the Caspian, through Persia, having been informed that the Khan of Khiva contemplated preventing his return. Leaving Bokhara towards the end of October, Pazukhin arrived, after three days' march, at the frontier town of Tchardjui; and on the 5th of December, the weather being intensely cold, at Merv, the first Persian town. The commandant of the latter place having received authority from the Shah of Persia, then at Ispahan, to allow Pazukhin to pass, gave him guides to conduct him to the town of Meshhed.

From Meshhed Pazukhin proceeded to the south coast of the Caspian, and arrived, without mishap, at the port of Liagiane (Lenkoran), from whence he embarked for Baku.

Not finding at this latter place any vessel to take him to Astrakhan, and it being already October, Pazukhin decided to winter on the coast.

From Baku Pazukhin proceeded to Shemakha. During this winter he and his companions suffered very much from want of provisions; they were obliged to borrow food, amongst others, from the Ambassador of Poland, who was then at Shemakha. They were also constantly subject to the attack of Lesghians and Persians, who fired upon them and carried off one of the liberated Russian captives. The envoy had not been authorised by the Tsar to make reprisals, so he refrained from punishing these people, in order to avoid giving cause for differences between the Tsar and the Shah of Persia.

Pazukhin finally embarked on the 11th of June, 1673, for Astrakhan with his suite and several merchants; and on the 29th of the same month reached that place.

On the 9th of October Pazukhin returned to Moscow, after an absence of four years and three months.

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PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED JULY 23RD, 1877.]

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SESSION 1876-77.

*Seventh Meeting, 26th February, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*Commander Alfred A. Chase Parr, R.N.; Sir Henry Thring, K.C.B.*

ELECTIONS.—*William Andrews, Esq., C.E.; Rev. Walter E. Browne; Samuel Davenport, Esq.; George Dobson, Esq.; John Emery, Esq.; Charles Henry Haines, Esq., M.D.; Frank Oscar Karuth, Esq.; Robert A. Laing, Esq.; John Lobb, Esq.; Major Gerard Noel Money (Bengal Staff Corps); Commander Alfred A. Chase Parr, R.N.; Sir Henry Thring, K.C.B.*

DONATIONS TO THE LIBRARY, 12TH TO 26TH FEBRUARY, 1877.—*Aus dem Natur- und Völkerleben im tropischen Amerika, Skizzenbuch, von Karl von Scherzer; Leipzig, 1864 (Author). The Balearic Isles, 1876, and The Cost of living abroad, 1876, by C. T. Bidwell (Author). Catalogue of the Library of the University of London, 1876 (The Senate of the University). The Coasts of Chile, Bolivia, and Perú; Washington, 1876 (The U.S. Hydrographic Office, per Commander R. H. Wyman). Haandbog i Geographien, af E. Løffler; Kjøbenhavn, 1876 (Author). Results of Observations at the Radcliffe Observatory, 1874, vol. xxxiv.; Oxford, 1876 (The Radcliffe Trustees). Polar Colonization and Exploration, by H. W. Howgate (Author). The Royal School of Mines Magazine, vol. i., Nos. 1 and 2 (The Editor). Les Voyages des Naturalistes Belges, par F. Plateau; Bruxelles, 1876 (The Librarian R. G. S.). Letter to*



the Shareholders of the Australian Agricultural Company, by R. H. Prance, 1877 (*Author*). L'Afrique et la Conférence Géographique de Bruxelles, par E. Banning, 1877 (*Author*). La Végétation du Globe, par A. Griesbach, traduit par P. de Tchihatchef, vol. ii., fasc. 1; Paris, 1877 (*M. de Tchihatchef*). The Grotto of Neptune, Sardinia, a poem illustrative of 3 views taken by the late Commander Alfred Miles, R.N., F.R.G.S., by Sibella E. Miles, 1864, with MS. poem on the late Arctic Expedition (*Mrs. S. E. Miles*). Statistical Register of Victoria, 1875, parts viii. and ix.; Reports of Mining Surveyors, &c., 30th Sept., 1876; and Victorian Year Book for 1875 (*The Victorian Government*). Early maritime intercourse of ancient Western nations, Japanese wrecks, and Origin of the Chinese race, by C. W. Brooks: San Francisco, 1876 (*Author*); and the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO MAP-ROOM FROM FEBRUARY 12TH TO 26TH, 1877.—MS. sketch-map of the Quilimane River, made by H. B. Cotterill, August, 1876 (*Bishop of Edinburgh*). Route-map of Rev. R. Price from Sadani to Mpwapwa (*Dr. J. Mullens*). The "Unrivalled" Classical Atlas; and "The World," a Classical Atlas. W. and A. K. Johnston, London and Edinburgh (*Publishers*). Native map of Chinese Turkistan (*Henry Kopsch, Esq.*). Map of Central Asia, by C. Ritter and F. Oetzel; Berlin, 1840; Map of Russian Turkestan, by Colonel Ilyin; Map of Russian Turkestan, by Captain Liussilin; and Map of Western Central Asia, by the Russian Military Topographical Dépôt, 1863 (*Major-Gen. Sir F. J. Goldsmid*).

The PRESIDENT, in introducing the subject of the evening, said that both the papers about to be read referred to recent explorations in Central Africa. One was by Mr. Young, on his late sojourn on Lake Nyassa, where he had the honour of launching the first steamer that had ever appeared on that lake. Mr. Young had for many years been known to Geographers for his zeal and success in African travel. He had been engaged at various times in Africa, and the reputation thus gained led to his being chosen to take out the Free Kirk Missionary party in 1875 to found the settlement Livingstonia. The second Paper was on a new route and a new mode of travelling in Central Africa, which had been adopted by the Rev. Roger Price. The great difficulty in reaching the highlands of the lake regions had been the malarious and marshy character of the country for 100 or 150 miles from the coast. Burton, Speke, Grant, Cameron, Stanley, had all suffered greatly in health, and been frequently detained, before they could reach the highlands. A happy idea had led Mr. Price to discover a route comparatively free from these disadvantages, and he had marched his bullocks to the central plateau and back again in an unprecedentedly short time.

The following Papers were then read:—

1.—*On a recent Sojourn at Lake Nyassa, Central Africa.*

By MR. E. D. YOUNG, R.N.

IN the month of June last year you did me the honour to lay before the Royal Geographical Society some brief notes which I sent from Lake Nyassa four months previously. I now avail myself of the opportunity furnished me this evening to give a more detailed account of the successful enterprise which I was privileged to conduct on behalf of the founders of the Livingstonia Mission, viz., the Free Church of Scotland. Although I shall endeavour as far as possible to keep within the limits which the objects of this Society impose upon me, I may, nevertheless, be permitted, I trust, to touch here and there lightly upon matters which were of all-absorbing interest to myself and my comrades, and inseparable from our motive in going to Central Africa. If I have specially to claim your indulgence for this in the course of a necessarily brief paper, I do it more confidently when I remember the large drafts made by this Society, from time to time, upon the knowledge gained by those who pass into hitherto unexplored lands, moved as they are to various efforts by the missionary spirit.

It is but a just tribute to the memory of David Livingstone, and a proper acknowledgment of the love of his countrymen towards him, to state that all that has been done upon Lake Nyassa is directly traceable to a determination to carry out the dearest wish expressed by the great traveller whilst he lived. He knew, and we who were with him knew also in the dark days of his disappointment, that to launch a steamer upon the waters of that splendid inland sea which he discovered in 1859, would do more to paralyse the appalling slave-trade carried on by Portuguese and Arabs in Eastern Africa than anything else. If he failed to convey the too cumbrous steamer *Lady Nyassa* across the Cataracts of the Shiré, his failure had this in it—it furnished me upon the spot with an experience as to what was possible and what impossible. Thus it enabled me to offer suggestions for another attempt in after years, which has proved, under God's good guidance, a perfect success. I need not occupy your time by describing the country bordering on the Zambesi and Shiré rivers. In passing, I may say that, since my previous visits, I found that an extraordinary flood, two years ago, had altered the course of both rivers at several points; but nothing materially interfered with our finding a convenient spot at the Kongoné mouth of the Zambesi, whereon to screw together the sections of the *Ilala*, nor to impede her passage to the foot of the Shiré Cataracts. It has

already been recorded here with what enthusiasm the natives on the Shiré flocked from all quarters when the news spread that the English were once more coming amongst them. We could not pass the well-kept graves of Bishop Mackenzie, of Mr. Scudamore, Mr. Dickinson, and Mr. Thornton, without feeling at every step how the lives of these men had gone far to win this reception for us, and that, although dead, they still lived in the confidence, the joy, the ready help we met everywhere. The Falls of the Shiré may be said to extend for some 75 miles. They present the only obstacle to bar the passage of a small vessel from the ocean to Nyassa. But the obstacle is a formidable one. Within this distance the waters of Nyassa leap down a staircase of rocks and boulders for some 1800 feet. Moreover, it is necessary to traverse a most rugged road before traveller or porter can reach the higher ground. In our case, however, the difficulty most to be dreaded had no real existence. The Makololo, left on the lower river by Dr. Livingstone, and the men amongst whom the members of the Universities Mission lived, brought together an enormous concourse of willing porters, and in ten days we were enabled to take to pieces our steamer, to see her sections, boilers, machinery, and stores safely conveyed above the falls; to transport all our goods and baggage, and that at a very small cost and without the loss of a single article of any sort either by accident or by theft, though we employed 800 men. When I state to you that the carriage of these steel plates and burdens, averaging 50 lbs. weight a piece, necessitated some of the most tremendous exertion I ever witnessed, when one remembers that these faithful fellows staggered amongst rocks and stones, up hill and down hill, in shut-in gorges where the heat ran up to 120° in the shade; when one thinks of the heavy boiler and what it took to transport it, I think you will admit that the men who did this four days' work for six yards of calico a piece (say 1s. 6d.), finding their own food too without a grumble or a growl from first to last, are not to be despised. The work of reconstruction, after so much hard toil, tried our mettle in every sense of the word, and our health too, but it was accomplished and steam was up in the *Ilala* within a fortnight. Our first stopping-place was M'Ponda's village, containing a thousand huts or more. To my great delight I met Wakotani here, one of the native lads left in the country by Dr. Livingstone in 1866, and I am glad to say that during my stay on Lake Nyassa he made himself very useful to me. Not so welcome, however, was the presence of a number of scowling Zanzibar Arabs. There was something very significant in the way in which one of them pointed to the badge

on my naval cap, and shook his head as he walked off with his comrades. We saw a number of slaves already pinned in the slave-sticks; and the character that M'Ponda's village bore, as the chief rendezvous of the slave-traders on the south border of Nyassa, was fully deserved from all we saw and heard. In spite of adverse influences at work, the chief gave us free leave to settle where we chose in his territory, and it was satisfactory to find that Cape Maclear, on which I had previously fixed my mind's eye, lay within it.

On the 12th October, 1875, we had steam up at daylight. I blew the whistle to attract the attention of the natives, who soon turned out in thousands along the river-bank. I sent a message to M'Ponda, asking him to take a short trip, that I might explain to him how the vessel moved; but he was too much frightened by what the Arabs had told him overnight: amongst other things, that our presence would cause evil spirits to enter him, that we should take his country away from him, and so forth. After making one or two runs up and down the river before all the people, we finally set off for the lake, accompanied by one of the chief's men and Wakotani. We entered Lake Nyassa at 7 A.M. There was a gentle breeze blowing, and the *Ilala* rode over the swell beautifully. Out of the fulness of my heart, I said "God speed you!" and "Amen" was the reply, I think, from all. We sang a hymn, and then held Divine Service: at the same time the *Ilala* was behaving beautifully, and doing her very best with a full pressure of steam. Coasting along the south-west shore, we examined numerous beautiful bays and inlets, but none afforded that shelter which was indispensable for our vessel in heavy weather. We called at Cape Maclear to wood, and found plenty of ebony, our principal fuel, some *lignum vitæ*, which burns better still, and hard woods of all kinds. An enormous population appeared in many places, but I found that the country had been much harried by the Ma Viti, a quasi Caffre tribe often mentioned by Livingstone and others, and who now are active in supplying the Portuguese of Tette with captives for the special interior slave-trade which is carried on by them upon the Zambesi. Marenga, an old friend of former years, and a powerful chief, had disappeared in the general turmoil. Passing on by M'Pemba, we sighted an Arab dhow sailing before us. As soon as the owners saw our flag flying, they lowered sail and waited for us to board her. I found no slaves, but only four miserable Arabs with a native crew; but the whole arrangements on board told too plain a tale concerning her calling. I found the owner could speak a little English, and that he hailed

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from Zanzibar. He fully made up his mind that the last hour of his dhow had come, but after a salutary warning I allowed him to pass on, not before he had questioned me as to how on earth we had been able to bring a steamer up from the sea, and had expressed a conviction that if the English could do this, they could do anything. We now steered a course E.N.E. across the lake, making for an Arab settlement at Loangwa; but here, too, we found that the place was destroyed by war, and that a powerful Ajiwa chief, Makanjira, had dispersed the former occupants.

Leaving the Loangwa mouth, we steamed back to Cape Maclear, making a stormy passage, but at the same time developing the powers of our vessel in a heavy sea. It would be impossible to have a better sea-boat, and it was not long before we had to test her to the uttermost.

Arranging to settle, at all events temporarily, at Cape Maclear, we set about discharging stores, and were fortunate enough to find an anchorage just such as we desired, well protected from prevailing winds, and with good holding ground. It became necessary to return to the head of the Shiré cataracts to bring up a portion of our goods; I availed myself of the opportunity to pay M'Ponda another visit, and was received with a hearty welcome. He happened to be sober—a rare occurrence—and I found him exceedingly sensible in his remarks. He admitted what a great slaver he was, but stated that the sale of slaves and ivory was the only means by which he could procure clothes and necessaries from the coast. A large gang of slaves had just started, under Arab escort, to cross the lake. I may here mention that this simple avowal lies at the root of the whole of the East African coast slave-trade. Neither Portuguese nor Arabs will encourage any other trade. Slaves are bought with one hand, ivory with the other; the slaves carry the tusks to the coast, and there both are disposed of. Once let legitimate trade be stimulated by opening up communication by land and by water, so that the india-rubber, the metals, the gums, the cotton, the dye-woods, the ivory, the beeswax, the hard woods, which are to be had in this rich country, can be brought to ports on the coast, and the slave-trade will wither at its roots. We accomplished our trip without let or hindrance, and were glad to find those whom we had left at the station in good health. Time will not allow me to describe to you our daily life here; the insight we got to the native life, the intrigues of the slave-traders, nor the marvellous effect our presence produced on all sides, more especially in attracting to us from the four winds the scattered remnants of villages swept away by slave-raids. I hope in another

form to preserve these details for the public, and I shall confine myself now to an account of our voyage round the lake, and the discovery of a large extension of its waters hitherto unknown.

We sailed from Cape Maclear on the 19th November, Dr. Laws of the Free Church, and Mr. Henderson of the Established Church of Scotland, accompanying me. Our first stopping-place was at Makanjira's on the south-east of the lake. My chief object in going thither was to gain permission from him, so that the mission represented by Mr. Henderson might be planted at the mouth of the Loangwa. Makanjira was very civil, and I found that, from having been at Zanzibar, he was well acquainted with the English. He is perhaps the greatest exporter of slaves to the coast of any one in these parts. Making our way northwards we came in sight of the grand range which towers over Chiloweela. In places the mountains run sheer down into the lake, and a short way from the shore we could get no bottom at 100 fathoms. For a long stretch it would be impossible even for a large vessel to find anchorage. We now reached Lesefa, which is the principal landing-place for slaves that have been transported by the Arabs from the western shores. Here too we noticed a sort of tacit understanding amongst the Arabs that the *Ilala* was the thin end of the wedge, and that sooner or later we mean to stop the traffic on this inland sea as we have upon the ocean.

At 3 A.M. on the 22nd, a furious gale sprang up. The *Ilala* dragged her anchors, and we had to get up steam and stand northwards; but so heavy was the sea, it became necessary to lie-to for four hours. As soon as it was safe to do so, we ran before the gale, and were "under water" for thirteen hours. At 5.30 P.M. we sighted a beautiful bay and found good anchorage. Still sailing northwards we passed the islands of Likomo and Chusamoolo. On our right an iron-bound coast stretched everywhere, save only when some ravine came down to the shore. In one spot we saw too plainly that a terrible massacre had taken place, for skeletons lay in all directions: we learnt that this was the result of a slave-raid on the part of the Ma Viri. It is their rule to slay every adult, without mercy, that is not fitted for the slave-market: in this case the captives had been disposed of to the Arabs. Here there is a subsidence in the mountain range, and the beautiful bays and inlets seem once to have been densely populated. Hardly any wood was to be procured in consequence of the forests being cleared, but now the only remnant of the people was found on rocky patches jutting up from the water of the lake, and on singular "pile villages." We found that the poor creatures had conveyed earth in their canoes to

these rocks, and wherever a crevice afforded a hold, there would a little patch of cassava or corn appear, grown with infinite labour. The platform villages to which we came soon, were exceedingly interesting. For the most part they are built 300 or 400 yards from the shore, and in from 8 to 12 feet of water. Poles are driven down in rows: on the top of these a wooden platform is constructed, and this is the foundation or floor of the village. To give some idea of the extent of these, I may say that one consisted of about 100 huts. With an abundance of fish around them the islanders hold their own against starvation. On the 25th, without any warning, a furious gale arose and a sea quickly got up that one would only expect to meet with on the Atlantic. I now began to see why Livingstone spoke of it as the "Lake of Storms." We nearly came to grief in our attempts to get more sea-room, for a deluge of rain falling upon the boiler at the first onset of the storm, condensed the steam so that the *Iala* would not answer her helm. However thankfully enough we got her head off shore, and stood away for the night. It rained hard and blew heavily, the ship labouring and all hands wet through and through. In the morning the weather moderated, and we stood in for the land.

We were now abreast of some mountains that, amongst the parallel ranges which virtually make a mountain-basin of Lake Nyassa, exceed them all in stupendous grandeur. In no part of the world have I seen anything to equal their peculiar magnificence. With peaks apparently 10,000 to 12,000 feet high, they run perpendicularly down into the lake. We got no sounding close under them at 140 fathoms. The rain was pouring upon them, and numberless waterfalls hung like threads of white floss-silk from crevices which ran out upon their sides far up among the clouds. Baffled by the raids of the Ma Viti in 1866, Livingstone could not induce his men to go with him to the north end of Nyassa, and thus he missed seeing that which would have struck him as the most beautiful feature of "his old home," as he called the lake. There was but one name to give to these mountains. At its northern end they stand like portals to the lake, faced by the opposite mountains; and as future travellers look on the "Livingstone Range" it may aid them to remember the man who, during his life, more than any other, added to our knowledge of the hitherto unknown beauties of the earth.

There is a gorge trending in an easterly direction from the head of the lake, filled by a wide marsh: for the two ranges are protracted northwards, and appear to overlap at some considerable distance off. The mouth of a river—apparently a wide one—was

visible; but it was necessary to continue our voyage, as there was no shelter and we were on a lee-shore. As it was, we cast anchor and took our chance. At sunset a desperate gale sprang up, and, with both anchors down and steaming to them, we expected to go ashore every minute. After the greatest peril we succeeded, thanks to a shift of wind, in getting to sea, and for three days and night, in the most fearfully wild sea and raging storm, we laid-to, under jib and mainsail, drifting in a southerly direction. It was not advisable to steer again for the marsh we had so lately seen in such weather, for no shelter could be procured in its vicinity. I learnt from the natives, when next we made the land on the north-west shore, that a River Rovuma or Rôoma flows out at the extreme north. I think this is so for the following reasons:—

In the first place, Dr. Livingstone heard the same story twenty years ago, when he discovered the lake, and in quite a different quarter. Many here will remember how sanguine he was that the Rovuma River, which debouches on the east coast, was identical with this Nyassa River, and that it would prove to be a second outlet. It may yet prove to be so, though it is only right to add the discovery can be of little use, for the Rovuma River ceases to be navigable a short distance from the sea.

My second reason for believing the native report is (and, let me add, the people had no reason for deceiving us) that in this stormy time it was very easy to see where rivers ran into the lake. A long current of muddy water would trail out on the dark-blue surface: here, however, at the Rovuma, there was nothing of the kind, and it seems conclusive, therefore, that no inflow exists.

We cruised with a southerly course along the western shore. Here, whilst one does not find such an iron-bound coast as during the 50 miles run along the base of the Livingstone Range, a peculiar delight is felt in studying the exquisite park-like glades which lie between the mountains and the shore. The herds of game merely looked up as we passed, just as sheep raise their heads to gaze at the train, and then went on browsing. In one place a most remarkable detached mountain appears, which I have named Mount Waller. It stands quite perpendicular for, say, 4000 feet. The top is flat, and the sides give it the appearance of a pyramid from which a large slice of the top has been removed in order to place in position a perfectly square block of a greenish colour. Beneath this singular summit there is a deep horizontal band of white stone or quartz, succeeded by another of clay apparently, and then comes one of intense black, possibly coal, for this mineral is known to all the natives. No regiment of Pharaoh's could have studied

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effect more carefully or insured in the centre of Africa a more singular and gigantic wonder.

After a further cruise, we reached that part of the western shore which was known to Livingstone, his brother, and Dr. Kirk, in 1862. Making for the islands of Chisomoolo and Li-Komo, we were able to dispel a pre-existing notion that some sort of a ferry was to be found in this direction. In one place only, and then for no great distance off shore, is there anything like shoal water. Lake Nyassa is a prodigiously deep inland sea, on which no small craft would stand a chance. When islands do appear above the water, they are the topmost crags of submerged mountains descending almost perpendicularly. Great islands of reeds and grass are from time to time driven away by fierce winds from their birth-place at the deltas of various rivers running into the lake. These get stranded on these peaks, and thus islands dot the surface in places. In sailing across from west to east, another terrific storm caught us. At one time, in the middle of a thunderstorm of great fury, no fewer than 12 waterspouts appeared at one time around us: we had literally to steer hither and thither to avoid them, for had one overtaken us it would have sent us to the bottom without a doubt.

Likomo is a large island, an exception to the rule. It is thickly populated, and extremely fertile. It contains a land-locked harbour, and is within easy reach of the shore. We were well received, and left the islanders delighted with our stay. To the Arab settlement of Kota Kota was our next cruise. This is the great exporting place for slaves, who are sent eastward. I came across my friend of the other side, who had arrived in his dhow. Able to speak English, and not above making a clean breast of things, I learnt from him that the annual traffic might be reckoned at some 10,000 slaves. It may be asked why did not we interfere with these men during the transit of these slave laden dhows. I can but say I was acting up to instructions, which very properly forbade me to do anything of the kind while planting these missionary stations. Situated as I was, it became policy to shut one's eyes to a good deal; in fact, it would have been impolitic to take the *Tala* again to the north of the lake after we regained Cape Maclear, because had we sighted one of these dhows again without taking notice of her occupation, it would have been assumed either that we did not, as English people, intend to interfere with the slave-trade at all, or that we were afraid to face them. As it is, the Arabs fully believe that we have taken possession of Lake Nyassa, and that their trade in human beings is about to be stopped: I only hope that they may prove right in their predictions. To detail to you

the further progress of the *Itala* toward Cape Maclear, our life there, the arrival of another large party under Dr. Stewart, the present head of the Mission, would only be to aggravate the offence I have committed in taking up so much time. I have related how the first steamer was placed on an African lake, and, with a thankful heart to Him who watched over us so mercifully. I pray that He may be pleased to turn her presence on Lake Nyassa to His wise purposes in the efforts of His servants for the regeneration of our poor oppressed fellow-creatures.

MR. YOUNG said he wished to make one fact public which was not in the Paper, referring to the great Ma Viti tribe, which had been the curse of the interior of Africa, and had almost depopulated the district between the sea and the Lake. Dr. Livingstone was desirous of getting hold of these people, but failed to do so. Before returning to England, however, he (Mr. Young), single-handed, met 300 of the warriors of that tribe, and made a treaty between them and the Makololo. The Mission was also the means of stopping a war between the Makololo and the Ajawas, and now they are great friends. Everything out there now looks very encouraging; and now I say "The land is before you; go in and possess it."

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2.—*A New Route and New Mode of Travelling into Central Africa.*  
*adopted by the Rev. ROGER PRICE in 1876, described by Rev. JOSEPH*  
*MULLENS, D.D.*

THE travellers who have journeyed into Central Africa from the East coast and the neighbourhood of Zanzibar have been called to encounter difficulties as formidable as may be met with in any part of the world. These difficulties have caused not only peril to health and severe trials of patience, but have occasioned them unusual expense. One object which most of them have kept in view was to reach the line of the three great lakes, and pay a visit to Ujiji.

The distance between Ujiji and the coast is measured pretty exactly by nine degrees of longitude (30° E. long. to 39° E. long.): and the journey from Zanzibar to the Tanganyika Lake may be divided very neatly into three stages of about three degrees each. The first stage carries the traveller to Mpwapwa and Ugogo; the second to Taboro or Unyanjembe; the third brings him to the Tanganyika shore. The distance (as the crow flies) is about 620 English miles: the travelling distance is just over 700. Very few have accomplished the journey under 1000*l.*; some have paid for it a great deal more. The experiences of the distinguished men who have hitherto performed it have proved of unusual interest. Burton, Speke and Grant, Livingstone and Stanley, and

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Captain Cameron and his companions, have made the route and its incidents familiar to all students of geography; nor has the youngest and latest writer of the series fallen behind his predecessors in the clearness, simplicity and judgment with which he has told his story.

So far as the *country* is concerned, the principal difficulties lie within the first section of the journey, the district between the sea-coast and Ugogo. About 200 miles in breadth, this district is divided into two portions of a hundred miles, each having its own character. From the coast at Bagamoyo, for the first hundred miles the land is in general level, until it reaches the roots and spurs of the hills; it then exhibits small enclosed valleys, with streams feeding the Wámi River, and causing numerous swamps and pools. The vegetation consists largely of brushwood, and of small forest with tropical plants and trees. A hundred miles in the interior the ground has begun to rise, and to exhibit lines of hills with parallel valleys, more or less regular, having a general trend to the N.E. These the traveller crosses, now mounting a high granite ridge, then descending; mounting higher, and descending a little again. In this way he crosses the broad swampy valley of the Mukandokwa or Makata River, passes the little Lake Ugombo, in which it rises, and winding among the noble hills of the Usagára Range, arrives at length at Mpwapwa, on the upper plateau, 3300 feet above the sea. Thence westward the journey is more easy. Passing through a gap in the Rubeho range, the caravan traverses vast rolling plains, with granite knolls covered with wood, with here and there forest, here and there thinly-scattered villages, and but few streams. At the end of the second two hundred miles it reaches Unyanyembe. Still journeying somewhat north-west over the rolling hills and the heads of valleys which trend to the west, the traveller comes to the inner edge of the high rocky level, and descends 800 feet to Lake Tanganyika, and the town of Ujiji on its eastern shore.

The difficulty and danger connected with disease arise from several causes, and are unusually great, especially between the sea-shore and the hills; while the effects of that first stage on the traveller's health frequently follow him and his people far into the interior. The natives suffer greatly; even Englishmen get fever—can get it often; and in several cases it has sooner or later ended in death. The steaming districts near the coast, with their swampy pools, doubtless abound in malaria. The water in many stopping-places is more or less poisoned from the same cause. The usual camping-grounds, occupied again and again by large

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bodies of bearers and slaves, are rendered unfit for tent-life. And rank vegetation, lines of rock and hill, may shut out those healthy breezes by which alone these poisonous exhalations can be driven away. But, in my judgment, the most frequent cause of fever on these long journeys is the great change in temperature between the heat of the day and the cool evening which rapidly follows. During the first hour after sunset the fall in temperature is very decided. Englishmen and natives arrive hot and exhausted, their clothes wet with perspiration, and the change in temperature, often increased by the strong south-east winds, soon becomes dangerous. A severe cold or attack of fever may speedily follow. The Englishman may guard himself by warm dress and hot coffee; but the native has few resources of the kind at his command, and is careless of using what he has.

The principal difficulty of African travel has, however, not been either the road or the fevers: it has been connected with the system of carriage. From the day when the ivory-trade of Zanzibar grew strong, and transport from thence to India, to the Persian Gulf and Aden, became easy and frequent, the slave-trade received a powerful stimulus, and gangs of slaves were made almost the only means of carriage. Hitherto all the English travellers in East Africa have been dependent upon these human bearers. From Burton down to the Church Missionary Expedition, which left the coast a few months ago, every one has been compelled to employ them. And the trouble they have caused by their fickleness, their dishonesty, their bodily weaknesses, their indolence, their diseases, and numerous deaths, has been indescribable. No one can read the experiences recorded in travellers' books without feeling the deepest indignation against these fickle men, and the profoundest pity for the traveller whose patience was so tried. No one who has read Captain Cameron's book will forget "Bombay." Where, at times, as many as three hundred such men have been taken in a single party, who can wonder at the worry, the detention, the waste of time and trouble involved in gathering them, keeping them together, fetching back runaways, starting them, bringing in stragglers, replacing the incompetent, and humanely caring for the whole? The outlay in wages has always been great, but property stolen, flung away by bearers, or left behind by the travellers for lack of men to carry the packages, has been far greater. The losses incurred in this way by every expedition have been exceedingly great.

Reflecting on these things, the Directors of the London Missionary Society, when planning their expedition to Lake Tan-

ganyika, thought it worth while specially to inquire into two points: (1) Could a route be found to the north of the Wámi River, on higher ground, and free from the swampy levels found here and there on the road from Bagamoyo? and (2) Was it possible to employ on the entire line the waggon drawn by bullocks, so common in the colonies of South Africa, and that without risk from the tsetse-fly? And as the Rev. Roger Price, who has had long experience of roads and waggons in South Africa, was then in England, they requested Mr. Price to proceed to Zanzibar to make these inquiries on the spot. The following is a brief outline of Mr. Price's proceedings, and of their result.

Mr. Price arrived at Zanzibar on May 2nd, 1876, and, having gained much information bearing upon his purpose, he resolved to pay a preliminary visit to Sadáni, on the African coast, and confer with Bwána Héri, the chief of the district, respecting a journey into the interior. His reception was everything he could desire. The chief entered heartily into the project, accompanied him to Ndumi, an excellent starting station, six miles from the coast, and promised a guide who knew the road. He assured Mr. Price that no fly was known on that road which killed bullocks, and that cattle were frequently brought down to the coast from the interior. The arrival of an ivory caravan from near Unyanyembe proved that the route proposed was actually in use, and the information derived from its people implied that it contained no special difficulties.

Mr. Price at once, therefore, proceeded to make preparations in Zanzibar for travelling into the interior as far as Mpwapwa, and examining the route for himself. He procured a select band of thirty bearers; purchased a supply of cloth and beads, to use as money; and endeavoured to obtain some kind of carriage with which to try his experiment. The Banyans at the Custom-house kindly gave him a cart, which, however, required extensive repair; and then he set to work to train bullocks. His experiences were somewhat amusing. He says:—

“Then came the oxen: the renowned French Charlie seems to be the only dealer in ox-flesh at Zanzibar. Accordingly, Mr. Donaldson and I proceeded to his place to see if we could get a pair. I had been told to expect difficulties here. It was evidently a puzzle to Charlie what anybody in Zanzibar should want with live oxen; and he had a strong suspicion that I was going to set up an opposition butcher's shop. He strongly recommended *mouton* and *mbuzi* (Swahili for goat); but for some time he could not be persuaded to part with any of his beesves. At last he seemed quite

convinced that I had no intention of interfering with his trade, and he would let me have two oxen, or four, or as many as I liked.

"The first ox was caught and led out, and made fast to a pole. The second proved to be a Tartar. He seemed quiet enough to look at or even to pat; but once the rope was round his horns, he began to show his mettle. We got him outside the kraal, but he did not remain there long: he made a jump over a railing that was ever so much higher than himself, breaking the top rail right off, and went back into the kraal in triumph. This was too much for Charlie altogether. 'That ox no do, gentlemen' (I was alone). I selected another: he was more reasonable; but I had to be satisfied to let them run loose through the street, till we got on the flat. There we caught them and put on the yoke. The one (Wales) took kindly to the yoke; but the other (England) was very stubborn, almost to the extent of lying down and refusing. After a good deal of the usual manœuvring in such cases, and a kindly and judicious use of the cane, we got England to carry the yoke with Wales. As usual at that time of the evening (five o'clock) there was a large concourse of people on the flats, who looked on with much curiosity. After some rough handling, England and Wales submitted to carry the yoke through the street into their kraal. Next morning I went to give them their second lesson, and then went out as far as Bishop Steere's place to get the bough of a tree for the oxen to pull. When England and Wales had in the course of four days got to pull pretty well, I ventured to catch a third ox. Scotland was wild and rebellious, clearing the street as I passed along; but once outside, and the yoke fairly on his neck, and the bush behind him, and with Wales as a mate, he set to work at once, and has not given much trouble since."

After training a fourth bullock, and exchanging an indolent ox for one more spirited, on June 2nd he says in his journal:

"To-day, both morning and evening, I have had my complete team of four in the little cart. This morning I drove out to Bishop Steere's place, my Kilangózi and myself in the cart. The Bishop and several of his party came out to see my little turn-out. Everything about it was closely observed, as the Bishop has quite an idea of waggon and oxen for Eastern Africa. The Bishop again congratulated me on the success which had so far attended my efforts. Asmáni was evidently not a little proud of his position beside the Mzungu (the Englishman) in the cart, and received with much satisfaction the acclamations of his numerous friends and

acquaintances along the roads, who shouted, 'That's the way you are going to take the Mzungu to Unyamwezi!'"

At the last moment the bearers began, as usual, to give trouble. But decision and good sense, and the confinement of their leader for three days in the Fort prison, reduced them to submission; and they proved in the end an orderly and willing band of men. A four hours' sail, with a fine breeze, carried the whole party across the water, from Zanzibar to Sadáni. The last preparations were made on the 9th of June, and the next morning the little expedition started for the interior. It included thirty men, all told, four oxen, a riding-donkey, and the cart: and as the caravan belonged to an Englishman, and contained some novel elements, the entire community of Sadáni assembled to see it start. The chief, Bwána Heri, expressed unbounded admiration of the cart arrangement, and was attentive and hospitable to the last. Mr. Price started on the 10th of June. In nineteen stages, long and short, occupying twenty-six days, he reached Mpwapwa, two hundred miles away, within the upper edge of the great plateau. He occupied only a fortnight in the return trip; and completed the entire journey of 400 miles, bullocks and all, in forty-two days. It is not necessary to tell the whole story; a few notes on special topics connected with the journey will suffice; and, naturally, the geography of the district occupies the first place.

Six miles from the coast, and lying due west from Sadáni, is the village of Ndumi. It stands on the summit of a knoll, which forms part of an elevated terrace or belt of country, which, from the sea-shore, has the appearance of a range of hills, and stretches north-east and south-west as far as the eye can see. Opposite Pemba this terrace juts into the sea. The route to Mpwapwa lies right across it; and the consequence is, that on that route the ground begins to slope upward at once, and the traveller loses swampy ground six miles from the coast; whereas, on the Bagamoyo road, he keeps on the low land for several days, is detained on that unhealthy district by troubles with his bearers, and suffers more harm there than almost anywhere in his onward journey. The ground between the coast and Ndumi is tolerably level; the only difficulty in the way of a road lies in the forest, grass, and jungle, which need to be cut away. A noble baobab-tree, on the summit of the little hill, renders Ndumi a conspicuous object.

Mkangé is one of many villages situated in a fertile valley, through which runs a fine stream of water. Mkuru is buried in the depths of a dense forest. So far the cart got on well. Beyond this place it caught on a stump; the body and wheels came to a

stand, and the oxen tore the front part and the pole completely away. Mr. Price therefore resolved to leave the cart behind, and to take the oxen on alone. Crossing over a succession of rolling ridges and little valleys, crossing the Rukigura, which flows from the north, passing three conical hills in the valley to the south, and Kanga Peak to the north and west, the little party came into the valley of the Wámi, some 40 miles north of Simbamwemi, on the Bagamoyo road.

At Kidúdwé Mr. Price entered the Nguru district, and soon reached the main granite range, which, in East Africa, forms the outer edging of the vast interior plateau. The Nguru Range is in reality the northern continuation of the Usagara Mountains, so wonderful in their grandeur, and so precipitous to climb, to which all the African travellers refer. Inside the Nguru Mountains, to the westward, is a range of detached hills—the Kaguru hills, amongst and beyond which live the Wakaguru and Masái. Here there is a remarkable gap in the granite masses, several miles wide, on each side of which the ranges appear as vast mountain-walls; and the new route passes between them to the west, the Nguru hills being about 6 miles distant on the north side. The broad valley between is wonderfully fertile. Villages and stopping-stations are numerous. Several streams from the northern hills flow through it down to the Wámi. The people are gentle and peaceable, and the country possesses abundance. The corn grows to a height of 16 feet, and the sugar-cane runs wild into jungle and forest. On the mountain-sides feed flocks of sheep and goats; to the north are large herds of cattle. It will be remembered that in South India there is a similar gap between the south face of the Nilgiri Hills and the north side of the Anamulli Range, and that the Madras Railway goes through it to the west coast on level ground, with a principal station at Palgaut, from which the gap is named.

Towards the west end of the gap the country becomes rocky, and still ascending, presents steep and rough hill-scarps, with narrow and deep valleys intervening. This is followed by a long stretch of comparatively smooth country; but for 20 miles it is uninhabited, and the district abounds in game. At Magubika steep descents and ascents again occur, and for a short distance the country looked hopeless for a waggon-road; but it proved the last of the difficulties. The party were near the edge of the plateau, and smooth easy country immediately followed. Mr. Price describes Kitángi as a beautiful spot. "Emerging from the pass, we gradually rose for about 4 miles, when there opened out to us the most cheering sight I had yet seen in East Africa. To the south-



ward lay the great Usagára Range, with a long gorge leading up into the very heart of the great mountains, which seemed piled up one behind another as far as the eye could reach. Through this gorge comes out the beautiful stream which gives its name (Kitangé) to the district, and which forms its principal water-supply, although there are several other smaller streams. To the northward, and round to the west and south-west, are high ridges and detached hills; the whole enclosing a basin about 10 miles wide. The whole of this was covered with a fine and comparatively short grass, such as I had often seen in the great pasture-lands of the south. There was but little bush except along the course of the ravines. The large spreading mimosa, growing in its usual fashion, here a solitary tree, there a clump of half-a-dozen, gave to the open parts of the basin quite a park-like appearance. As this lovely scene was viewed from the height which we had attained, I could not help saying to my South African servant, 'Oh, that I had a waggon and a span of oxen now, and a proper African whip!' As might be expected, when we descended into the Kitangé basin, considerable flocks and herds began to appear. But what was most interesting to me, was the sight of the villages with which the whole of this great basin was dotted over. Look wherever I would, I could not fail to discover several of these, often within rifle-shot of one another. Up the sides of the great mountains, on both sides of the Kitangé gorge as far as the eye could reach—east, west, north, and south—they were to be seen. The villages are mostly of the Tembé kind. This mode of building seems necessary in this part of the country, where they have none of the protection afforded by the thickets nearer the coast. One of the saddest features of the state of things in East Africa is the constant fear which the people have of being attacked. It is a rare thing to see a male above the age of twelve or fifteen, by day or by night, in the town or out of it, without arms of some kind."

From Meomboni, a pool near the top of the Kitangé ridge, the route lay across an immense flat, with very little water, and nights that were very cold. In the early morning the thermometer stood at 45°. Hence in two stages the party reached Mpwapwa. This station is well known to African travellers, and has been specially described by Mr. Stanley.

In enumerating the difficulties of this route for waggons and oxen, Mr. Price specifies the long thick grass, so abundant near the coast. Cornfields spread out around the village, and it is difficult to avoid them. The jungle and forest are usually thin, except in

certain limited spots, where a few men with good American axes would soon clear the way. Some of the ravines and gullies look ugly enough; but spades and pickaxes will render them passable. There are three rivers, or rather mountain-streams, on the route, which will give trouble when swollen by the rains; the Rukigura, the Mvue and the Mkindo. But waggons starting from the coast in July would probably find all these rivers fordable. The hill country is a difficulty; but to an old South African it is nothing formidable. "On the entire route there is not a place to compare for difficulty with roads which the colonists pass daily: and the ordinary road between Graham's Town and Algoa Bay is more difficult than the route which I travelled in going to Ugogo. Every bit of hilly road between Saadáni and Mpwapwa put together would not amount to more than 20 miles." As to the difficulty most feared of all, the tsetse-fly, which seems to be a trouble on the Bagamoyo road, he says: "I regard the absence of tsetse between Saadáni and Mpwapwa as settled. I took the four bullocks with me the whole way, and left them at Saadáni on my return, apparently in perfect health. Cattle, sheep and goats are to be met with here and there along the whole route." Dr. Moffat gives it as his experience that it is the increase of population which destroys tsetse. And it may be that the occurrence of the gap in the new route, with its fertile level, its numerous villages and broad cultivation, and the general population along the route, explain the difference in this matter between the jungly, mountainous and ill-peopled district to the south, and the more open, dry and cultivated route to the north of the Wámi River.

In regard to the results of this pioneering journey, Dr. Kirk, living on the spot, and discerning the full value of an improved method of communication, writes to Lord Derby in very warm terms. He says: "Mr. Price's journey has been in every way successful, and he returns prepared to give a most favourable report on the road, the country, and the temper of the people among whom he passed." After giving some account of the journey, he concludes his despatch by saying: "I have thought the above sketch of his proceedings may not be uninteresting to your Lordship, as indicating a practicable means of developing at once the resources of the interior, in a way that, so long as every article sold or bought had to be carried by porters, could never have been done."

Agreeing heartily with these views of Dr. Kirk, and convinced that there is solid ground for believing the old plans of South African travel to be perfectly applicable to these new regions in

Central Africa, the Directors of the London Missionary Society are now fitting out their expedition to Lake Tanganyika on the basis suggested by Mr. Price. Containing five or six Englishmen, its equipment will consist of two waggons and eight carts, covered with waterproofs; teams of twelve oxen for the waggons, and six for each cart, with a small reserve, will make up a body of eighty oxen, of whom it is desired that a portion shall be obtained from among the well-trained oxen of Natal; yokes, waggon-gear, and some Kafir drivers and leaders will also be sought in Natal. Tents for camping, stores for a period of two years, a fair supply of barter goods, beads, and wire (partly for payments on the road and partly as money at their final destination); a good supply of tools for workshops and industrial schools; also of medicine for a dispensary; as well as of seeds of fruits, vegetables, and grain, are now being prepared as outfit for the expedition. It is expected that they will only spend the month of June on the sea-coast, and that with July the waggon-train will commence its march into the interior. Time, thought and care have been devoted to these preparations, because the importance of the experiment is perceived, and all concerned are anxious that it shall prove a complete success.

If this expedition, and that of the Church Missionary Society which has preceded it, merely contemplated a visit to the Lake Region, they would excite but a passing interest. But times have changed with Central Africa. The experiences and revelations of each new traveller have deepened the interest felt in its truest welfare, until all classes of Englishmen are anxious to see its tribes protected, delivered from the wrongs from which they have suffered, stimulated to industry, enlightened, taught, and civilised. These expeditions are but precursors of a strong stream of civilising and beneficial agencies, which will continue to flow into this great region for many generations to come. Those agencies are of many kinds. These ignorant and injured races in the interior need the doctor, the surgeon, the skilled artisan, as well as the missionary and the teacher. The honourable trader is needed to help them in exchanging their native produce for English money and English goods, that their energies may be stimulated, and their resources increased. We have, therefore, to contemplate the permanent residence of Englishmen in the interior, and, with their residence, that continued elevation of the social condition of the natives, and that continued exposure of wrong-doing, by which our right-minded countrymen, travellers, traders, colonists, and missionaries, have conferred such great benefits upon many nations of the world.

To secure this safe and permanent residence, and with it the

enlargement and increase of honourable trade, it appears to me that two things are necessary; the formation of a direct road, and the establishment of a line of stopping-stations. These measures are essential to the success of everything else, and with them other measures will move forward rapidly. Presuming that the waggon-train will be found to answer, so far as we at present know, the northern line of route visited by Mr. Price is not unsuitable in itself, and is a route free from the tsetse. It is specially suited to Englishmen, because it soon runs over rocky ridges, and is open and free of swamps. At the very outset the town of Ndumi, 6 miles from the sea-coast, is on the edge of a high terrace. A good road to it, which could be made with ease, would carry a traveller, his goods and waggons, at once away from the low level near the sea; at Ndumi he could make his final preparations in comfort, under circumstances very different from the heat and swamp of Bagamoyo. The expenditure on such a road would depend upon the degree to which natural inequalities in the ground are levelled, and forest and jungle are removed. Quite as important as the road is the subject of stopping-stations. A waggon-train carrying valuable goods, with few men, needs protection at night; the oxen need to be preserved both from straying and being stolen. In South Africa the straying of oxen at night is the cause of endless anxiety, detention and worry. What so useful for this protection as the *serái* of Northern India? A small outlay of money would without difficulty provide a series of *seráis*, at intervals of 20 miles, which would bring a trader or traveller to Mpwapwa probably in fifteen to twenty days, into a region with dry healthy air, and moderate heat, where he could live in comfort. Mpwapwa itself, or some new place near, might be made an important head-station; and, having its base at Saadáni and a good road from that place, would be both a secure and profitable place of trade to English merchants. It stands at the point where two or three lines of roads from the coast meet together. A great portion of the trade of the interior passes through it, and Mr. Price points out that "many a caravan, especially the purely native ones, which now go to the coast to be taxed and fleeced right and left, would hail an establishment at Mpwapwa where they could get what they wanted, and would gladly avoid the difficulties between that place and the coast." The system of *seráis* would scarcely appear strange to the native tribes, for their own *tembes* are *seráis* on a larger scale, constructed in much the same fashion, and having the same security in view.

It seems to me that it is in this first section of the long journey to the lakes that the traveller, at the present time, specially needs

this kind of help. Make easy the route for his waggon-train so far; place him without an hour's delay at Ndumi on rocky land; beyond that point give him the stopping-stations, where his cattle and his goods shall rest in their journey, secure and well supplied; carry him by these means speedily across the lower or fevered country on to the healthy plateau; and already you have solved one of the greatest difficulties in the long journey that lies before him. In due time let the same be done for other chief stations and smaller resting-places, in the second and third stages of that journey. The trade will soon change hands, and a healthy reform in the present method of intercourse and traffic, tantamount to a revolution, will bring the heart of Africa near to Europe, and will bind it in closer bonds to the whole civilised world.

Captain WILSON, R.N., said it might not be generally known that Mr. Young began his African career with Dr. Livingstone in 1862, by commanding the *Pioneer*, the vessel which was placed by the Foreign Office at the disposal of Dr. Livingstone on the Zambesi. Mr. Young remained in command there for two years, and acquired a great deal of experience. After that, in 1866 or 1867, the report came home that Livingstone had been killed near the south end of Nyassa. The Government of the day did not believe the statement, and Sir Roderick Murchison induced them to send out an expedition under Mr. Young to ascertain the truth or falsity of the rumour. That expedition returned to England with the news that Livingstone had passed on beyond the place where he was supposed to have been killed. When Mr. Young came home he was very properly rewarded by the Admiralty with an excellent appointment in the Coast Guard, where he lived until Livingstone's remains were consigned to his last home in Westminster Abbey. Several African friends then met together, among them Dr. Stewart of Hope-dale, now at Lake Nyassa, to consider the practicability of carrying out Livingstone's wish and establishing a Mission on Nyassa. Dr. Stewart asked Mr. Young to become the leader. Mr. Young consented. They then went to Scotland, and called together two or three meetings. The Scotch were a practical people, and at the end of a little discussion the idea was approved of. In a very few weeks 10,000*l.* were subscribed. In six weeks from that date the steamer was built. She was a vessel of about 25 tons displacement, 47 feet long, 12 feet broad, drawing 5 feet 6 inches of water, a good sea-going boat, schooner-rigged, and a very fast steamer. She was put together with nuts and screws. Mr. Young left England in May, and by October he had got his steamer conveyed past the Murchison Falls, and was steaming up into Lake Nyassa. From the sea to the Lake looked a mere hop, skip, and a jump on the map, but in reality, owing to the meanderings of the river the distance was upwards of 400 miles, and having himself pulled up to the foot of the Falls, he knew what difficulties had to be encountered. Mr. Young had treated them as a mere bagatelle; but if the difficulties on the Lake were much greater than those on the river, they must be quite as much as any ordinary man could overcome. Mr. Young carried his 40 or 50 tons of goods past the Rapids, put his steamer together a second time, launched her on the Lake, and circumnavigated it. There were one or two matters which Mr. Young had not referred to, but which deserved prominence. At two or three different points on the lake large numbers of cattle were seen. Opposite one of the islands there were no less than 200 head. Another fact, showing

the enormous importance of Lake Nyassa, was that five large dhows were seen there. A dhow was a vessel of considerable tonnage, and he was not aware that in any other part of the large lakes of Africa anything larger than a canoe had ever been found. The five dhows were probably not less than 300 tons burden, and there must, therefore, be a very large trade in those parts. The Mission was no ordinary assemblage of Church people; it was a real, substantial, practical Mission. Every man who had gone out was a double-handed man, able to work as well as to preach. There were carpenters, blacksmiths, agriculturists, sailors, carefully selected for the work, so that they might teach some useful occupation to the natives. But Mr. Young did not only establish a Mission, he founded a Colony; and at Cape Maclear there was now a colony fairly started. Houses had been built, a fort erected, and a slip formed for hauling up the vessel and repairing her. A large water-way had also been cut to let the water out from the plains, so that the crops should not be destroyed by the inundations. For the eighteen months that Mr. Young had been there his sense of duty was such, that he never slept one night out of his little steamer. With reference to the second Paper, it was most desirable that an overland route should be formed; but if the Zambesi could be opened to free trade, no overland route would be able to compete with it. The writer of the Paper had stated that it cost 1000*l.* for each traveller who crossed from Zanzibar to the Tanganyika; but the expense of placing the steamer on Lake Nyassa, sending out eight persons, and maintaining the Mission for one year, was in round numbers only 4500*l.* From the north end of the Lake to the sea, there was water-carriage for at least 700 miles, while from Tanganyika to the north of Nyassa there would be only 180 or 200 miles of land-carriage. By the overland route, on the other hand, there were at least 700 miles of land-carriage to the north of Tanganyika; while by the Zambesi route there were 1200 miles of water-way, and only 250 miles of land-travelling to the same spot. It seemed to him that the natural outlet of Africa on the East was by the mouths of the Zambesi, and the efforts of this country should now be directed to opening up that river to free trade. If that was done, the slave-trade of course would cease. The slave-trade was necessary in a country where there was no animal carriage. The ivory must be carried to the coast, and for this purpose slaves were employed; but if water-carriage were obtained, the whole difficulty would be solved.

The PRESIDENT said it was interesting to see how, in this age of progress, things were accomplished in the course of a few years, which formerly used to require centuries even to mature the thought of action and a practical issue. The description of the foundation of the Mission on Lake Nyassa was more like the old stories of the Moravian missions, than of a mere missionary enterprise, because it involved the teaching of trades, and the carrying on of all the practical arts of life and civilisation. Mr. Cotterill, a son of the Bishop of Edinburgh, was already going over the same ground; his object being to see whether, by establishing a legitimate trade, a blow might not be struck at the root of the iniquities of the slave-trade. Every Englishman must feel the greatest interest in the enterprise, and wish it success.

The BISHOP OF EDINBURGH said, according to the last account, his son had only just reached Nyassa, and therefore nothing was yet known of any experience he had gained in regard to the object which had taken him out to Central Africa. He did not go out as a trader himself, but to discover which were the best channels for trade, and what were the best products of the country. He was intrusted with a certain amount of goods by merchants, both in Scotland and England, not with the idea of gaining any profit by the adventure, but only as an experiment. No one knew better than Mr. Young that it was utterly hopeless to expect to make a profit until the Zambesi was

opened for free trade. He did not think there was any objection to his mentioning that his son obtained, through the Foreign Office, from the Lisbon Government, a free pass through their territories in Africa, on the understanding that it was to be an experimental expedition; but, instead of having free passage there, he was charged 26 per cent. on the goods that he was taking out, and his diaries showed that every possible obstacle was thrown in the way of his progress by the Portuguese officials there. At Lisbon, he believed, the authorities disowned any complicity with the slave-trade, and no doubt they were not aware of what was going on, but it was certain that the Portuguese officials in Africa encouraged the slave-trade. Mr. Young had referred to a trade in slaves with Tete on the Zambesi, and he had heard from his son-in-law, who had explored the Matabele country, that slaves were sent down there from the Portuguese settlement at Tete, and that he had seen the slaves himself. There could be no doubt that the Zambesi and the Shire were the natural outlet for the trade of the Nyassa district, but there were still several difficulties to be overcome. He thought it was a great mistake to go to Quillimane at all. Some people seemed to imagine that the Quillimane was one of the mouths of the Zambesi, but for a considerable part of the year, as was shown by a map which his son had sent home, the Mutu, a branch of the Quillimane, did not communicate at all with the Zambesi. The members of the Expedition were detained at Quillimane for nearly three weeks by the Portuguese authorities. Another fortnight was occupied in struggling up the stream, to a place from which they had to carry their boats overland to Mazaro. At this latter place they were again detained by a Portuguese official, who charged six times as much for the canoes he supplied as the natives charged for theirs. It took another three weeks to reach the foot of the Murchison Cataracts. To carry the steel boat, which was given by the masters and scholars of Harrow School (where his son was formerly a master), up the Cataracts required another week. No doubt it would be much easier to get down the river from the Lake. He was afraid that the boat was scarcely suitable for such a stormy lake: one of the principal difficulties of transit on the lake being the severe storms which occurred there.

Sir BARTLE FRERE said, to African travellers like Dr. Moffat, Colonel Grant, General Rigby, and Colonel Gordon, the accounts which had been given in the Papers just read, must appear like a pleasing dream. Dr. Moffat would recollect that, when he went out to his mission, there was not a steamer on or near any river in Africa. For some time after that, there were none nearer than Malta, none in the harbour of Alexandria, none upon the Nile; but at the present time there was not only steam communication along the coast, but steamers had actually been placed upon the lakes. It was a by no means improbable dream that ere long Mr. Young might shake hands with Colonel Gordon on the deck of one of their steamers. There was another most important sign of progress. Mr. Price, coming as he did from a noble stock of discoverers, had found a way by which to substitute cattle-power for the human beings who, over so many roads in Africa, were still the only means of communication and of carriage. Some of those gentlemen whose inquiries had led them into the ancient doings of the people who lived upon the lakes of Switzerland before the Romans introduced their civilisation into Europe, must have thought that they were listening to an account of the ancient Helvetians, and of some of the long-headed people who preceded the Picts and Scots on the borders of the Scotch lakes, who used to adopt exactly the same devices to protect themselves, as Mr. Young had found prevailing in Africa. However, it was to be hoped that a ray of light had now been let in upon the savage tribes of Africa, which would very soon be followed by broad daylight.

Sir SAMUEL BAKER said, as he had spent nine years in Africa, he felt ex-

treme interest in the rapid progress that had now set in there. Only a few years ago the map of Africa, instead of being filled up as at present, was endeared to idle school-boys from the fact of its containing nothing for them to learn. The great mystery—the solution of which had been attempted by the greatest of the ancients, even by the Cæsars themselves, and given up as an impossibility—had at last been attacked by England. Headed by Livingstone, who gave the impulse, Englishmen had set themselves to explore the continent; and not one who had started in command of an expedition had failed to gain his object, and be rewarded by the approbation of his countrymen. The great difficulty had always been the want of means of transport, and the route from Zanzibar had been proved to afford facilities which no other part of Africa possessed, as carriers could be obtained there. The expense, however, was so enormous, that few people could afford to engage in explorations on their own resources; and even few societies, except the Royal Geographical, had means for such work. The greatest question now was, how to improve the means of transport. He had been exceedingly gratified to hear that Mr. Price had started the use of bullock-waggons: in fact, it was strange that they had not been used before. The steamer which Colonel Gordon now had on the Albert Nyanza, a vessel of 38 tons, besides two life-boats of 10 tons each, a steamer erected at Gondokoro, of 108 tons, and another of 250 tons, now travelling up from Khartum, were all carried 400 miles across the desert, by the expedition which he (Sir Samuel) had led. The transport was accomplished by a man who unfortunately was now dead, the lamented Edwin Huginbotham. One of the pieces weighed 8 cwt., which could not possibly have been conveyed except by wheels. This was taken on the gun-carriages of 32-pounder howitzers, lashed together and drawn by camels. Forty-two railway-truck loads of machinery were transported to Gondokoro, without the loss of a single screw. This showed the advantage of wheeled carriages, without which it would have been utterly impossible to have moved a great weight, such as a steam boiler, across the desert. It must be gratifying to the Royal Geographical Society to note the success with which African exploration had been carried on since Livingstone first started it, and Speke and Grant opened up the new route to the interior; and to remember that, without the assistance of the Society, the continent would still be the blank which it formerly was.

The Rev. ROGER PRICE said he should like to feel that the sympathy of the Royal Geographical Society had been secured in behalf of the great work which was now being carried on in Central Africa. An African bullock-waggon was a rough concern, a slow coach, but it had done a great work in the south. He had himself seen a huge boiler at a distance of 1400 miles from Cape Town, which had been taken there whole by the bullock-waggon. It was of course a great weight to get on a waggon, but the colonists there had their own ways of getting over difficulties. They made a hole and buried the waggon, and rolled the boiler on to it. Towns of 40,000 or 50,000 inhabitants were now to be found far inland, where six or seven years ago there was nothing but a wild, howling waste, and all the material for building these towns had been taken there through the agency of bullock-waggons. He hoped that similar wonders would be wrought by the same means in Central Africa. In connection with the new route which he had discovered, a steamer of light draught was needed at Zanzibar, as at present the only means of transport from that island to the mainland were Arab dhows. It was to be regretted that at the commencement of the route there was not a better port than Saadani, but no doubt the skill of engineers could get over that by making a jetty. He would also desire to lay stress upon the necessity for making a road across the coast regions, which was about one-third of the whole distance to Tanganyika, but equalled in difficulties the other two-thirds. The great plateau would offer no



special difficulty in the way of the establishment of a waggon-route, and he expected that a sufficient road would be made by the passage of one waggon after another. Something better than that would, however, be required for the coast region and the mountain ranges. It would always be more or less unsafe to traverse that region, in consequence of the amount of water and the risk of fever; and it was therefore desirable to adopt means for making the journey across it as speedy as possible. It was important to have at least two stations. One he would recommend to be established on the western border of the valley of Nguru, about the southern end of the Nguru mountain range; and another at Mpwapwa, which was a most important, though by no means an interesting place. It was there that the various routes from the coast met, and from thence a fresh start was made for the long journey across the plateau to the Lake. It could be made an important *dépôt* during the dry season, for he took for granted that for some time to come it would be impracticable to traverse the coast region during the height of the rainy season. The dry season, however, was sufficiently long for the stuff required for commerce to be brought to Mpwapwa and deposited there, to be conveyed to the far interior whenever necessary. In these undertakings the Royal Geographical Society could give valuable assistance. If the Cape bullock-waggon was successfully introduced into the interior, the time would not be far distant when a steamer of very considerable pretensions would ply upon the broad and beautiful waters of Tanganyika.

The PRESIDENT, in concluding the meeting, said the papers and the discussion might be almost summed up in two words, bullock-waggon and steamer. These applied, the one to the land, the other to the lakes, would effectually open up Central Africa, and work all the marvels of an Aladdin's lamp. Nothing could be more encouraging than the progress the work of Exploration had made, under the auspices of the Royal Geographical Society, since Livingstone gave it the first impulse. The Society could desire no greater honour or brighter wreath than that which it had gained by contributing to the opening up of Africa to civilization and commerce.

Votes of thanks were accorded to the authors of the Papers, and the meeting then adjourned.

*Special General Meeting, March 5th, 1877, 3 P.M.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT. in the Chair.

The purpose for which the Meeting was convened is explained in the following Circular, which was posted, within the limits of time required by the Regulations, to all Fellows whose addresses in the United Kingdom were known :—

1. SAVILE ROW, S.W.,  
*February 23rd, 1877.*

A SPECIAL GENERAL MEETING of the Fellows is convened for Monday, March 5th, at 3 P.M., at the Hall of the University of London, to consider the following Resolutions, of which notice has been given by Sir Mordaunt Wells :—

“That a Committee of six Fellows of not less than ten years' standing be appointed to investigate the circumstances relating to the issue of Visitors' tickets, to whom, and by whom, such tickets were granted on the occasion of the Meeting of the Royal Geographical Society, at St. James's Hall, on Tuesday, the 12th day of December, and the authority for the same.

“That the officers of the Society be requested by the Council to furnish the Committee with such information as the Committee may deem necessary and advisable.

“That the following Fellows be appointed to act as Members of the Committee :—

Sir ALEXANDER ARMSTRONG, K.C.B. and F.R.S.,  
Colonel H. F. AINSLIE,  
Professor M. C. VINCENT,  
Sir MORDAUNT WELLS,

together with two Fellows of the same standing, to be nominated by the Council.

“That the President be invited to preside over the proceedings of the Committee.

“That three members of the above Committee shall constitute a quorum, and that the Committee be empowered to report the result of their proceedings at the Meeting of the Society to be held on the 12th of March, 1877.

“That the Meetings of the Committee be held at the office of the Royal Geographical Society, 1, Savile Row.”

Sir Mordaunt Wells notified his intention of moving the above Resolutions at the Evening Meeting of February 26th; but as nothing relating to the Regulations or Management of the Society can, according to the Rules, be brought forward at the Ordinary Meetings ('*Charter and Regulations.*' chap. v. sec. 3, para. 5), the Council, in accordance with these Rules, have called a Special Meeting for the purpose.

A full attendance of Fellows is requested.

C. R. MARKHAM,  
R. H. MAJOR,  
*Secretaries.*

\* \* As none but Fellows can be admitted, it will be necessary that each should be ready to produce his “Fellow's Ticket” for 1876-7, on entry.

By direction of the Council, the following Explanation, relating to the Rules and practice concerning Admission to the Evening

Meetings, was also sent to the Fellows before the day of the Special General Meeting:—

1, SAVILE ROW, S.W.,

March 1st, 1877.

IN prospect of the Special Meeting to be held on March 5th, the President and Council of the Royal Geographical Society have thought it desirable to lay before the Fellows a statement of the Rules and practice hitherto adopted, for the accommodation of Fellows and Visitors, at Evening Meetings of the Society.

Until the Annual General Meeting held on May 24th, 1875, each Fellow was entitled, under a Standing Rule of the Society, to introduce one gentleman or two ladies, as Visitors, at any Evening Meeting. As the number of Fellows now exceeds 3000, if this privilege had continued in force, and been fully exercised by every Fellow, the attendance on an occasion of exceptional interest might *possibly* have amounted to above 9000—a larger audience than could be seated within any Hall in London. To guard against an overwhelming influx of Visitors, and to give Fellows a reasonable precedence in the distribution of seats, certain restrictions on the right of introduction have from time to time been sanctioned by the Society. For instance, by another Rule, not yet abrogated, it was provided that no Visitor should be admitted before the Chair was taken, unless personally introduced by a Fellow or by a Council card, but it was found practically impossible to enforce this Rule in face of the determined opposition offered by influential Fellows, and the attempt to do so was abandoned after the experience of one Session. The plan of railing off several front benches for Fellows not accompanied by Visitors was frustrated by similar difficulties, and though it is still the custom to label two front benches “For Fellows only,” even this limited reservation is not always respected. In the mean time, since Visitors’ tickets were not required to be dated, it constantly happened that many Fellows signed more than two for the same evening, especially when the Meeting was unusually attractive, thereby appropriating more than their fair share of the available space.

It was to remedy inconveniences and irregularities of this kind that, at the General Meeting of May 24th, 1876, the Rule first cited was amended by the addition of a clause “empowering the Council to restrict the privilege of admission to one friend for each Member, whenever such restriction seems to them absolutely necessary.” Acting upon this authority, and in accordance with the recommendation of a Special Committee, the Council has introduced the present system of dated Visitors’ tickets, one of which may be filled up by each Fellow for each Evening Meeting. This Regulation is still in force, and governs the admission of Fellows and Visitors at all the Evening Meetings of the Society. At Ordinary Meetings the system thus established is found to work very well. One bench, nearest the platform, is set apart for Members of the Council and their friends, in accordance with the practice of this and other learned Societies. Two other benches are allotted to Fellows not accompanied by Visitors, and the rest of the Hall is left free to Fellows and to Visitors presenting dated tickets. Of course, disappointment is sometimes expressed by Fellows coming in late and failing to obtain an eligible place, but few, if any, definite complaints of the arrangements made for Ordinary Meetings have reached the Council.

On the other hand, the arrangements made for Meetings of exceptional interest, whether at Burlington Gardens or St. James’s Hall, have often been the subject of criticism, and the pending Motion of Sir Mordaunt Wells expressly refers to one of such Meetings, held at St. James’s Hall on December 12th, 1876. The complaint which it embodies is understood to rest on two

distinct grounds: (1), that an inordinate number of ladies and other Visitors occupied the body of the Hall to the exclusion of Fellows, many of whom, arriving at the hour appointed for the opening of the doors, found the best places already taken; (2), that an inordinate number of seats were reserved by the President and Council for their own friends.

1. Upon the first point it may be observed that, unless and until the amended Rule is repealed or suspended by a Resolution of the Society, the President and Council have no power to control the right of each Fellow to issue one Visitor's ticket for each meeting. No such measure has yet been proposed, nor have the President and Council any reason to believe that it would be acceptable to a majority of Fellows, while it would assuredly prejudice the popularity of the Society. The extent to which Fellows avail themselves of this right on special occasions, is perhaps the best proof of the value attached to it. During the few days which preceded the Arctic Meeting of December 12th, no less than 1600 Fellows applied for and obtained their Visitors' tickets, and many subsequently applied for extra tickets. As St. James's Hall is only constructed to accommodate 2000 persons, it is manifest that if all these Visitors had gained admission, but a small fraction of the Fellows could have been seated at all. As a matter of fact, the first comers were of necessity first accommodated, no distinction being made in favour, either of persons holding Visitors' tickets, or of Fellows coming without Visitors. It is true that, owing to causes which the President and the Council regret, but over which they had no control, many Fellows and Visitors succeeded in possessing themselves of good places before the appointed time. The explanation of this circumstance is that, finding the approaches so thronged as to obstruct the traffic seriously, the police ordered the doors to be opened, and those who happened to be on the spot reaped an advantage which may well have appeared unfair. But the Council are not aware that anyone obtained an entrance except Fellows, or Visitors holding tickets, and the proportion of those excluded to those admitted would have been exactly the same had no such miscarriage occurred.

2. In the distribution of reserved seats, as well as in the general arrangement of the Meeting, the President was assisted by a Special Committee of the Council, the members of which also consented to act as Stewards. The whole number of seats reserved amounted to 406, of which 200 were on the platform, 58 in the balcony, and 148 on the floor of the Hall. No complete list exists of the individuals to whom these seats were assigned, but it is not difficult to specify the various classes recognised by the Committee as having a special claim to such precedence. Besides the President, the Members of the Council, the Officers of the Society, and the Officers of the Arctic Expedition, reserved seats were provided for H.R.H. the Prince of Wales and his suite, the Foreign Ambassadors and Ministers, the Lord Mayor and Lady Mayoress, the Lords of the Admiralty and their Secretaries, the heads of several Public Departments, the Presidents of various learned Societies in correspondence with the Royal Geographical Society, some ex-Members of the Council of the Royal Geographical Society, the Officers of previous Arctic Expeditions, the Officers of the *Porpoise*, the editors of leading newspapers, and a few other persons of distinction, the residue being occupied by the relations and friends of Arctic Officers, and Visitors introduced by the President himself or by Members of the Council, to each of whom two reserved tickets were allotted. Thus, excepting the President and Council and Officers of the Society, with a small number of Visitors invited by them, all the reserved seats were filled by public guests of the Society, selected by the Special Committee, under the authority of the President and Council, and including a body of Arctic Officers, numbering, with their friends, little less than 100.

Having made this statement, the President and Council do not think it necessary to justify the manner in which they have exercised the discretion entrusted to them by the Society, feeling assured that, if it should be impugned, they will be supported by the general voice of the Fellows. They do not believe that any fresh Regulations will avail altogether to overcome those inherent difficulties which arise from the size and constitution of the Society, or to relieve them of the responsibility which must ever devolve upon the governing body, in the interest of all the Fellows. They are, however, fully prepared to review the operation of the existing Rules by the light of recent experience, and to consider any improvements that may be suggested. With this view, they have recorded in a Minute—an extract from which is hereto appended—their readiness to concur in the appointment of a joint Committee, nominated in equal proportions by themselves and by the Fellows, but they would now further propose to omit the qualification of ten years' standing for the Members so nominated. The alternative proposed in the Resolution of Sir Mordaunt Wells is one which it is impossible for them to accept, since it implies, if not censure, yet a want of that confidence without which it would be difficult, if not impossible, to conduct the affairs of any Society in a satisfactory manner.

By order of the Council.

C. R. MARKHAM,

R. H. MAJOR,

*Secretaries.*

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*EXTRACT from a MINUTE of the COUNCIL of the 12th February, read at the Evening Meeting of that date, with Sir MORDAUNT WELLS' notice of Resolutions.*

The only question is, whether any alteration can be made in the Rules of the Society or in the practice hitherto observed on great occasions, which may, without injury to the best interests of the Society, tend to remove any complaints on behalf of the Members. Such a question the Council are the first to acknowledge is a proper subject for investigation by a Committee.

The Council, then, propose that a Committee should be appointed, consisting of an equal number of members of the Council and of Fellows of over ten years' standing, to be selected from the general body, the President of the Society being the Chairman *ex-officio*. The duty of the Committee will be to inquire into the working of the existent Rules and practice and to report thereon, with liberty to recommend for the approval of a General Meeting any new Rules or modifications in practice with a view to remove as far as possible all causes of complaint or dissatisfaction.

The proceedings of the Meeting began by Sir MORDAUNT WELLS proposing his Resolutions in accordance with the notice given.

The Motion was seconded by the Rev. J. WHICHELOW.

The Hon. G. C. BRODRICK offered some explanations on behalf of the Council, of similar nature to those contained in the Circular given above.

Lord ABERDARE then proposed the following Amendment to the Resolutions of Sir MORDAUNT WELLS:—

That a Committee be appointed, consisting of five members of the Council and five Fellows to be selected from the general body, the President of the Society being the Chairman *ex-officio*; and that the duty of the Committee be to inquire into the working of the existent Rules and practice, and to report thereon, with liberty to recommend for the approval of a General Meeting any new Rules or modifications in practice, with a view to remove, as far as possible, all causes of complaints or dissatisfaction.

Mr. F. CALVERT, Q.C., seconded the Amendment.

Sir MORDAUNT WELLS replied on the Amendment.

The PRESIDENT put the Amendment to the Meeting; but before the show of hands "to the contrary" was taken, Sir MORDAUNT WELLS said he was prepared to accept the Amendment, provided Lord ABERDARE would consent to tack it on to the original Resolutions.

On Lord ABERDARE declining to do this, as tending to complicate the matter, the Amendment was definitely put, and carried by a large majority.

A division was then demanded, on the ground that the Meeting did not quite understand the issue before them. But, at the suggestion of the Right Hon. A. S. AYRTON, the Amendment was again put as a Substantive Resolution.

On a show of hands being again taken, the Amendment in this form was again carried by a large majority.

On the motion of Lord ABERDARE, seconded by Sir MORDAUNT WELLS, the following gentlemen were selected to act as Members of the Joint Committee on behalf of the general body:—

Sir MORDAUNT WELLS,

Sir ALEXANDER ARMSTRONG, K.C.B., LL.D., F.R.S.,

General Sir GEORGE BALFOUR, K.C.B., M.P.,

Dr. ALFRED BARTON.

F. CALVERT, Esq., Q.C.

The proceedings then terminated.

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*Eighth Meeting, 12th March, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Godfrey Darbshire, Esq.*

ELECTIONS.—*James Coate, Esq.; Charles E. Cooper, Esq.; Edward Prichard Evans, Esq.; Joseph Faulkner, Esq.; Rev. William Theophilus Giles, M.A.; Robert Logan Jack, Esq.; James Kennard, Esq.; Colonel Henry Man (Madras Staff Corps); John Thomas Howie-McEwan, Esq.; Arthur A. Pearson, Esq.; John Alexander Sandilands, Esq.*

DONATIONS TO THE LIBRARY, 26TH FEBRUARY TO 12TH MARCH, 1877.—Archæological Survey of Western India; Report on the Antiquities of Kāthiāwād and Kachh, by J. Burgess, 1876 (*H.M. Secretary of State for India*). The Changes of Exmouth Warren, by J. M. Martin, Pt. 2, 1876 (*Author*). Perseverance in Arctic Exploration, by J. O. Chadwick, 1877 (*Author*). The Gem Geography, by J. A. Butterworth, Pt. 1 (*Author*). Charts of Meteorological Data for nine 10-degree Squares of the Atlantic, with accompanying Remarks, 1876 (*The Meteorological Committee*). Catalogue of the Royal Engineer Corps Libraries, 1876 (*The R. E. Corps, per Lieut. F. J. Educards*). Histoire de l'Asie Centrale, 1153–1818, par Mir Abdoul Kerim Boukhary, Persian text and French translation by Charles Schefer, Paris, 1876, and Persian text of the Relation de l'Ambassade au Kharezme, par Riza Qouly Khan, publications de l'École des langues Orientales vivantes (*The Minister of Public Instruction in France, through H.B.M. Ambassador in Paris, favoured by Lord Tenterden*). Report of the Kew Committee for year ending October, 1876 (*The Committee*). Zur Frage der Meeres-circulation, von H. Schmick (*Author*). General Report of the operations of the Marine Survey of India, 1874–76, by Commander A. Dundas Taylor, Calcutta, 1876, and List of Light-houses, &c., in British India, to 1st January, 1877, by R. C. Carrington, Calcutta, 1877 (*Commander Taylor*). Géographie de la Soie, par L. Clugnet, Lyon, 1877 (*The Lyons Geographical Society, per M. A. Brun*). The trade of Central Africa, present and future, by V. L. Cameron, 1877 (*Professor Tennant*).

DONATIONS TO MAP-ROOM, FEBRUARY 26TH TO MARCH 12TH, 1877.—Map of Western Australia, showing Explorations made between the years 1872 and 1876; Surveyor-General's Office, Perth, W.A. (*John Forrest, Esq.*). Four sheets of the Topographical Atlas of Denmark, 1860 (*Royal Danish Ministry of War, through Count von Bulow*). MS. map showing Country round Port Moresby, New

Guinea, by Octavius C. Stone (*Author*). MS. map of River Beni, Bolivia, showing proposed routes of exploration, by Juan B. Minchin (*Author*). MS. Sketch-map of Country about the Source of the Joliba, West Africa, by Benjamin Anderson (*Author*). Map of Perak and Sangalore, Wellesley Province and Pulo Penang, by Major McNair, R.A.; Sketch-map of Country round Malacca; Sketch of the Perak River; Survey of River Linghy and of Tracks from Linghy to Rassa, and from Lukut to Rassa, Sunghy Ujong (*W. Barrington d'Almeida, Esq.*).

The President announced that two Papers were to be read; the first by Mr. Buchanan, who had served as chemist on the scientific staff of the *Challenger* Expedition. It related to the distribution of salinity in the ocean, or its saltiness at different depths and in different latitudes; and dealt with several interesting problems in Physical Geography, as to the dissolving power of the water, its specific gravity, its effects upon the deposits. The second Paper was by Mr. Allen, of Her Majesty's Consular Service, on an interesting journey he had made into the interior of Formosa, a part of that island, occupied by aborigines and savage tribes. A third Paper on the same island was by Mr. Bullock; extracts from which would be read, if time permitted.

The following Papers were then read:—

1. *On the Distribution of Salt in the Ocean as indicated by the Specific Gravity of its Waters.* By J. Y. BUCHANAN, Chemist in the *Challenger* Expedition.

[ABSTRACT.]

THE specific gravity of the water from the surface was determined every day during the cruise when at sea, and from the bottom and intermediate depths as often as opportunity offered. The instrument used was a glass hydrometer, combining the advantages of Nicholson's hydrometer with those of the one with divided scale. The results obtained with it were accurate to 5 in the fifth decimal place. The observations were always made when the water was sensibly at the temperature of the atmosphere, the results so obtained were reduced, by means of the tables of the late Professor Hubbard of Washington, to their value at the standard temperature of 15.56° C. (60° F.), the density of distilled water at its temperature of maximum density being unity. In this way the specific gravity of nearly 2000 different waters was determined. These were all ocean waters—that is, they were from localities free from the local effects caused by proximity of land—and the specific gravity of such waters has been found to vary between 1.024 and 1.028, between which limits we may assume with certainty that the salinity varies with the specific gravity.

The distribution at the surface of saltiness thus indicated was



exhibited on a chart by means of differently coloured areas, and the vertical distribution was shown in the diagrams representing meridional sections of the Atlantic and Pacific Oceans respectively.

As far as the surface is concerned, the general results were as follows. The concentration of the waters of the Atlantic is greater than that of either the Pacific or the Southern Ocean, and it is greater in the North Atlantic than in the South Atlantic, although the actual maximum may be slightly higher in the South Atlantic. In the North Atlantic the maximum was observed in  $22^{\circ}$  N. latitude and  $40^{\circ}$  W. longitude, from which point it diminishes in all directions. The maximum in the South Atlantic was  $1.02785$  off the coast of Brazil, in latitude  $17^{\circ}$  S. In the Pacific the areas of concentration are much less pronounced, the maximum of  $1.0272$  occurring near the island of Tahiti. In the North Pacific the maximum is under  $1.0265$ , and situated about  $22^{\circ}$  N. Between the north and south maxima in these oceans is situated the area of equatorial dilution. Following the equator from east to west in the Atlantic, the water increases markedly in saltiness: in the Pacific the same is the case, though in a less degree. On the polar sides of the areas of concentration the saltiness diminishes as the latitude increases, at first rapidly, then more slowly. The whole of the Southern Ocean between the parallel of  $40^{\circ}$  S. and the edge of the ice appears to have a very uniform surface specific gravity of about  $1.0250$ . In the North Pacific, to judge from Lenz's observations, it is lower, and in the North Atlantic higher.

If we consider the water below the surface, as shown in the vertical sections, we find, in the Atlantic, that in the concentration-areas the specific gravity diminishes until a minimum is reached at a depth of about 800 or 1000 fathoms, after which it increases slightly down to the bottom where, in the South Atlantic and in the Pacific, a tolerably uniform specific gravity of  $1.0257$  to  $1.0259$  is observed. In the areas of equatorial dilution the specific gravity first increases to a maximum at a depth of 50 to 100 fathoms, after which it follows the same law as the water north and south of it. In the North Atlantic the bottom specific gravity is comparatively high. In investigating the causes of the variations in specific gravity in the ocean, we find that they depend on the means available for removing or supplying water. Thus the areas of greatest concentration coincide with those where the dry trade-winds are constantly blowing, taking their rise in the lower temperate latitudes, and proceeding in their course always from colder to warmer regions, so that, for the first part of their journey, at least, although they are continually taking up moisture, their capacity for doing so is continually increasing. Hence the great concen-

tration of the water in the steady Trades of the Atlantic. On the other hand, the westerly winds of the higher temperate latitudes which take their rise at the same source, proceeding in the first part of their course from warmer to colder latitudes, are soon comparatively saturated, and incapable of concentrating the waters over which they blow. The moisture taken up by the trades is wrung out in the equatorial calms, where it descends as heavy rains, and dilutes the sea water. Comparing the salinity of the sea surface with the distribution of barometric pressure, we find that the maximum of saltiness lies in the northern hemisphere to the south-west, and in the southern hemisphere to the north-west, of the barometric maxima. Concentration is also brought about by the formation of ice, and in regions where more ice is formed in winter than melts in summer, which in the southern hemisphere would enclose a very large area, the effects must be cumulative. In the Southern Ocean the specific gravity of the bottom-water was always much higher than that of the surface.

The high-bottom specific gravity in the North Atlantic depends not only on the lake-like form of the basin in which the water is kept by tangential winds and currents from getting out of the concentrating effects of the trade-winds, which effect is propagated downwards to a great extent by the difference between the summer and winter temperatures, but also on the fact that all the accumulations of salt brine from the Mediterranean are emptied into it through the Straits of Gibraltar. It is probable that a similar effect is produced on the Indian Ocean by the proximity of the Red Sea.

The observations make it probable that in the Atlantic the water from the surface, down to a depth of 1000 fathoms, has on the whole a flow *inwards*, or from south to north, and below that depth and down to the bottom it appears to have an opposite flow, thus providing for the removal of the salt which otherwise would accumulate in the North Atlantic. The Atlantic thus presents on a larger scale what is observed in the Mediterranean, where the mean drying power of the atmosphere is higher than even in the North Atlantic. In the Pacific, owing to its form and general climate, these conditions are not so evident.

[The above Paper will be printed *in extenso* in the 'Journal,' Vol. xlvii.]

MR. FRANCIS GALTON asked Mr. Buchanan whether, as a rule, in passing from one ocean-current to another, his instruments gave any indication of the change. It was obvious that two adjacent currents must usually have different amounts of salt in their composition, and he would like to know if, with the very delicate instruments used by the *Challenger* Expedition, and the great precautions which were taken in making the observations, such differences became sensible.

Mr. BUCHANAN replied that there was no doubt that in the currents of the ocean there was very considerable difference in the specific gravity of the water, as well as in the temperature. In the chart suspended before the Meeting the Gulf Stream was very clearly indicated simply by the specific gravity, or rather the edge of it, where the warm and dense water of the Gulf Stream met what was called the "cold wall" of the Labrador current. The Equatorial currents also were very marked, being fresh. The Agullas current of South Africa showed similar variations in density.

The PRESIDENT said the Society was much indebted to Mr. Buchanan for his interesting Paper on a subject involving various scientific problems. It was calculated to throw considerable light upon many of those questions, but he was afraid the Meeting was scarcely competent to discuss them at any length. Such Papers, however, must tend very much to improve their knowledge of Physical Geography, precisely on those points on which it was most difficult to collect authentic facts. Such facts could only be obtained by an expensive and elaborate expedition, such as Her Majesty's Government fitted out in the *Challenger*. Mr. Buchanan was one of the body of scientific men who were sent on the three-and-a-half years' voyage, and the Paper which had just been read contained merely a fragment of the valuable results which had been obtained. When the whole of those results were made public, it would no doubt be shown that the Government of a civilised and cultivated country like England could not possibly devote some portion of its funds, and the energies of its scientific men, to a better object.

## 2.—*Notes of a Journey through Formosa from Tamsui to Taiwanfu.*

By HERBERT J. ALLEN, H.M. Consular Service, China.

LITTLE is known of the interior of Formosa, and a short sketch of a journey from the Treaty port of Tamsui to that of Taiwanfu, in which the heart of the island was visited, will perhaps be of some interest. Formosa, situated about 100 miles from the mainland of China, is about 240 miles by 80 broad. The Chinese name of it, Taiwan, or Bay of the Raised Terrace, probably refers to the square flat-roofed blockhouse, Fort Zelandia, built by the Dutch when they were in possession of the island, and which is now a mark for vessels making the anchorage at the capital, Taiwanfu. The department is, according to Government statistical works, divided into the subdistricts of Komalan, Tamsui, Changhua, Kia-i, Taiwan, Fengshan, and Pênghu, or the Pescadores, of which Komalan is the only one on the eastern side of the island. The Chinese Government charts do not depict the coast-line on that side at all, the boundary being represented by a mass of mountains. The central ranges, the southern and eastern coasts, are principally inhabited by various tribes of aborigines, totally unlike in dress and features to the Chinese, who call them barbarians, and treat them accordingly. Some of the districts have been so enlarged lately by the constant encroachments of the Chinese on savage territory that last year it was deemed necessary to increase the number of governing officials; Komalan and Tamsui districts were abolished, and a department of North Formosa, with three dependent magistracies,

established in their room. The Chinese Government forbade their people to cross the boundary of savage territory, at one time well defined; but since the Japanese expedition against the Bootan tribe of aborigines in the south in 1874, they altered their policy, and, finding themselves looked on as masters of the whole island, took active steps to improve their knowledge of it. Schemes for cutting roads through the hills were set on foot, colonists were bribed to settle in out-of-the-way places, and presents given liberally to the aboriginal chiefs, who were urged to acknowledge Chinese rule. These measures have not been altogether successful, in consequence of the persistent antipathy and mistrust shown by the savages, and the petty war goes on whenever the Chinese try to penetrate into the hills unaccompanied by a large force.

Being invited by Mr. Mackay, of the Canadian Presbyterian Mission in the north, and Mr. Ritchie, of the English Presbyterians in South Formosa, to accompany them on a tour they intended to take to visit their respective stations, I started on the 10th of November, 1875, from the old Dutch fort, then used as a Consular residence, at Tamsui. I crossed the harbour near its entrance, and skirting the western side of the Kuanyin Hill, 1720 feet above the sea, gained the table-land, which stretches some 30 miles down the coast. I halted at the little village of Doaheng for dinner, and went on 10 miles further by moonlight to the inn at Tionglek, where my companions were sleeping, they having earlier in the day left their chapel near Banka, the largest and most commercially active town in North Formosa, 8 miles up the Tamsui River, and gone by another road. The next morning we made an early start, and the air on the plateau being very invigorating, walked 8 miles before breakfast, passing many villages of Hakka Chinese immigrants from Kuangtung Province. The plain was cultivated with paddy and sugar-cane crops, and we constantly met heavy four-wheeled carts with axles, doubtless introduced by the Dutch, which were generally drawn by a buffalo, with two of the ordinary black cattle of the country on each side, yoked abreast. About 8 miles from Tekcham we reached Table Hill, or Windhill Slope, as its Chinese name signifies, which was the termination of the plateau. From this point we got a good view of the sea westward, the valley with its pretty river winding along at our feet, and clumps of bamboos on the opposite bank, which screened the town from sight. Descending the hill, we crossed the river in one of the flat-bottomed boats used here. The ferryman held on to a rattan-rope, securely fastened to stakes at each bank, as he swung his boat across the stream, which in the rainy season becomes a rapid torrent.

Tekcham, being the capital of the Tamsui district and containing the jamên of the sub-prefect, has acquired a sort of fictitious importance which its trade does not warrant. At the time of my journey the sub-prefect was absent in another part of his district, which stretched along the north and west coasts for a distance of, say, 100 miles, with a breadth of from 10 to 30 miles, and covering an area of 1250 square miles.

On our third day's march we soon came to the sands, which stretch some way out to sea, and make this part of the coast very dangerous for anything but flat-bottomed Chinese junks, and there had, in fact, been two wrecks of English vessels lately, as the timber lying about the shore testified. A proclamation posted at a road-side inn by one Lo, assistant commandant of the North Formosa troops, warned the people that they would be punished if they carried off the wrecked wood, on the ground that the ocean-men (foreigners) might make capital of the fact, and create disturbances. The authorities have certainly been more energetic than they were in old days in putting a stop to the evil of wrecking, although they work on the fears of the common people rather at the expense of our reputation. We passed through the large towns of Heongsan and Tiongkong, crossed a sandy shallow inlet of the sea half a mile wide, which afforded a good anchorage for junks, and leaving the large town of Oulan on our right, soon came in sight of Sinkang, our destination for the day. We were warmly welcomed by the catechist of the chapel here, who came running to meet us, and lodged us in the Mission-rooms. We had had a tedious march of 20 miles, most of the way over a desert, and had been not a little annoyed by the sand blown into our faces by the high wind. Sinkang is the last of Mr. Mackay's stations, and as it is but one day's journey from Laisia, the most northerly of the South Formosan Mission-stations, there is a complete chain of chapels from Kelung in the north to Takow in the south. Most of the converts in Sinkang are Pepohuans, or semi-civilised savages of the plains, who are found generally established in small colonies between their Chinese conquerors and their brothers, the wild aborigines of the interior. They practically adopt the Chinese dress and tonsure, but their features distinctly show that they were originally of the aboriginal or Malayo-Polynesian stock. A simple-minded and quiet people, they are looked down on by the Chinese as huans, *i. e.* barbarians, and they do not scruple to possess themselves of their lands, under pretence of renting them, the complaints for redress to the officials being too often unattended to. On the side of the hills they are frequently cut off by the wild savages, who look upon the acqui-

sition of human heads with pigtails as proofs of valour, without a certain number of which a young chief cannot get a wife. The Pepohuans are sometimes called Sekhuan, which means civilised barbarians, to distinguish them from the Chihuan, or wild barbarians, and are governed by tongsu, or headmen. The one over this tribe paid a squeeze of 300 dollars a year for his post, part to the sub-prefect of Tamsui and part to the sub-prefect of Lokong, in the Changhua district, under the jurisdiction of which latter official he more immediately is. After leaving Sinkang we passed a string of Hakka Chinese villages, the largest of which was Bali. Rice and sugar are grown in this valley, and people seemed well-to-do. We halted at midday at Tunglowan. Crossing the rocky bed of what would evidently be a torrent in the rains, we travelled up a long and very pretty valley, then over a small range of hills, and towards evening came down a very steep hill to Laisia. This Pepohuan colony, which is entirely Christian, the population of which numbers 200, including women and children, is an offshoot of the huans of Posia. They said thirty or forty of them came here twenty years ago, and that they were of the Padjieh tribe, the tribe at Sinkang being called Balua. The colony consisted of two small enclosures, about 100 yards square each, well fenced in with bamboos, and further protected from attacks of savages by sharp-pointed stakes, which stuck up a few inches out of the ground close to the outside of the fence.

On the sixth day we resumed our march, and passing through the small Chinese village of Sintiam, which has sprung into existence within the last two years, struck along the base of the hills over a plain some miles wide, strewn with rocks and boulders, without any discernible path through it, and reached Toasia early in the afternoon.

As we were now going to have rougher travelling than we had had, we despatched a courier to Taiwanfu with our surplus baggage, and letters to inform the Consul of our plans. We went s.s.e. for 13 miles over a fertile plain, cultivated with sugar-cane, tobacco, ground-nut, sweet potatoes, &c., drawing gradually towards the range of hills on our left. At the head of the gorge, due east of the district town of Changhua, we were met by a party of thirty or forty tall, stalwart Pepohuans, armed with knives and matchlocks, who were to be our bodyguard through the mountains, to protect us from the savages. The gorge wound a good deal, but our general direction was east; the jungle on both sides was very thick, and the Pepohuans now and then set it on fire. After we had gone about six miles over rocks and stones, through pools of

water, the pass narrowing as we went, we reached a point where a big camphor-tree blocked it up almost entirely, and we had great difficulty in getting the chair through. The pass was here only 5 feet wide, and I could touch the perpendicular walls of rock on each side. The scenery was magnificent; the mountains, rising 2000 or 3000 feet almost perpendicularly on each side, were covered with camphor and other forest-trees. At one time a felled tree across our path made an arch for us to pass under, and again we were obliged to scramble along the trunk of another big denizen of the forest. I noticed one or two veins of coal on the rocks; and a stratum of conglomerate pebbles in the clay, 600 feet above us, was also remarkable. We encamped for the night in the middle of the gorge; lit a fire, and boiled some of our tinned soups in true gipsy style. Blankets spread on bundles of leaves formed our beds, and in spite of a heavy dew we got a good night's rest. We started before daybreak on the morning of the eighth day of our march, and after five more miles of rough scrambling, at which our savage friends were quite *au fait*, got to the end of the gorge. The ranges of hills now opened out, and, although we occasionally had to cut our way with long knives through the jungle, travelling was much easier work. We found a small, edible, acid fruit, like a raspberry, growing here; as well as a sweet-smelling fern, which the natives called Tanpa. We did not meet any wild savages; but were pointed out a spot where, five years previously, the Pepohuans had a fight and killed thirteen of them. We crossed one pretty broad and rapid stream, in fording which the Pepohuans were immersed up to their necks, and six or seven smaller ones; and just after dusk reached the beautiful valley of Posia, or Polisia as it is also called. Torches had been sent to meet us by some of the party, who had pushed on quicker than the others; and the Chinese chair-coolies, being dead-beat, had to give place to the stalwart Pepohuans, who, with shouts of laughter at the unaccustomed task, picked up the chair and came along over the level ground at a rapid trot which nearly shook me out of it. We slept that night in comfortable beds at the Mission-station of Ougulan, one of the 33 villages in this plain. Posia is a fertile, almost circular, well-watered plain, about 8 miles in diameter, and surrounded by wooded hills in which the wild savages roam in their hunting-excursions. The population, numbering about 5000, include a few Chinese who come to trade with the Pepohuans in rattans, deers' horns, skins, &c., for which they exchange knives, matchlocks, and gunpowder. The Pepohuans are fair shots. We were out in the woods one day for a few hours, and they succeeded in bagging three moose-deer, the

flesh of which was excellent. The missionaries have been very successful here. Their first chapel at Gukunswa, so called from a hillock said to resemble an ox reclining, on the other side of the plain, was built in 1871; the one at Ougulan was next put up; and a third one, with an upper storey, substantially built of brick, was built at the village of Toalam in 1874. I was shown a silver cup, about two inches long, which an old man assured me had been an heirloom in his family for 200 years. From some marks on it, I believe it is really an old Dutch matchbox. They said they remembered the foreigners being in the island. We remained five days at Posia, and were continually being feasted by the converts, a troop of whom escorted us to the bank of a river at the edge of the plain, when we took our departure. Of course we had a small bodyguard to escort us through another pass to the south, not so difficult as the one by which we had entered the plain, and as far as Ousia, a small village of perhaps 1000 Chinese inhabitants of Changchow. They then saluted us by firing their matchlocks in the air and shouting "Pahuria raki" (Peace be with you), returned to Posia. We passed some plantations of tea and before dusk reached the shores of a beautiful lake, 4 miles long by 2 broad, which went by the name of Tsui-sia-hai, or Lake of the Water Savages, a distinct tribe who live on its banks. They are a degraded race, and are employed as slaves by the Chinese, who make them carry heavy burdens, and give them samshoo, of which they are unfortunately only too fond. We found some of them lying intoxicated in their long low huts made of the bark of trees, and resembling their canoes inverted. The whole family live in the hut, which has partitions which only partially screen the women's quarters from those of the men. They tattoo their faces in broad bands across the nose, are tall, and would be well-proportioned, if it were not for a pernicious habit they indulge in of tying cloths tightly round their waists, which deform them very much; but which they said they did to keep them from feeling the pangs of hunger. They fish in the lake, paddling about in long canoes hollowed out of the trunks of trees, which reminded us of the dragon-boats common at Foochow and other parts of South China. I bathed in the lake, and found it very muddy and full of weeds. On a woody islet in the lake, we found a Chinese coffin-maker, who seemed comfortable enough with his bit of kitchen-garden and orchard adjoining his house. A Chinese scholar who lived near the lake took us in, and gave us quarters for the night. The next day, the fifteenth of our march, we travelled in a south-westerly direction over the hills, descending eventually a



steep hill, from the top of which we had a fine view of a long valley, with a river flowing from east to west. We reached that evening the large town of Chipchip, which is entirely Chinese, and is the headquarters of a military Mandarin, named Lo, who, we heard, was in command of 500 troops, two days' journey up the valley, employed in cutting a road to Siukuluan, a port on the east coast of the island, in lat.  $23^{\circ} 30'$ . We had tried to get a Chinese guard to bring us through the hills in the morning; but as there was some difficulty about it, and we were a large enough party to awe the savages, we gave it up. We left Chipchip early the next morning, but were detained some time on the bank of a river. The ferryman had gone away, and some of the helpers swam across to get the boat. They were, however, unskilled in the management of it, the force of the current washed it down against a fish-weir, and it was wrecked. This little *contretemps* obliged us to cross lower down on a raft. We passed a good many villages, one of them, Limkepo, said to contain 3000 inhabitants, had jurisdiction over 24 others in the vicinity. The valley we were travelling through wound about a good deal, and although we did not make much way in a direct line, it was getting dusk before we reached Toulak, our resting-place for the night. An underling from the district magistrate's *yamén* at Kagee met us here, and said he had been ordered to escort us to Kagee. He helped me in engaging another chair, my former bearers not wishing to go on to the capital, and was very attentive. We struck the main road at Tapona, where we had a good cup of tea at the house of a Mr. Huang; passed a few villages, at the largest of which, Tamao, my companions preached for a short time while we were resting; and reached the Mission-chapel at Kagee on the evening of the seventeenth day. I sent my card to the Magistrate to thank him for his kindness, but he was not at home. I was now within two days' journey of Taiwanfu, and so I bid *adieu* to my companions, who were going to visit some more stations in the hills to the eastward, and journeyed on *solus* to Ungkangbay. I slept at a comfortable inn kept by a Government underling; and early on the nineteenth day, after a journey of 220 miles, reached Taiwanfu, the capital of the island. Passing through the city gate, I went for some distance along pretty lanes bounded with cactus-hedges, no house being even in sight, and eventually found myself in the hospitable *yamén* of the British Consul. I stayed here some days, waiting for a vessel to take me across to the mainland, and spent my time pleasantly in making excursions to objects of interest in the city and visiting the few foreign residents in it. I went over the square Dutch fort in the

city, on the gateway of which can still be traced the date "Anno — 1650;" and also over the remains of Fort Zelandia at Amping, 3 miles off, on the sea-coast. It was being rapidly pulled down by the Chinese, in order that the bricks might be used in the erection of a grand new fort with four bastions, which was being put up under the superintendence of some French officers, a few miles off, to repel the Japanese and other invaders. I made a quick passage of twenty-four hours to Amoy, in an English merchant-vessel, and was rather sorry to leave Formosa.

Mr. J. THOMSON, on being called upon by the President, as one who had travelled in Formosa, and brought home a magnificent series of photographs illustrating the scenery and natives, said he hardly knew any spot in the world better calculated to illustrate certain phases of Physical Geography than Formosa. The great central ridge, running from north to south, was so elevated, and its distance from the sea so small, that during the rainy season the excessive drainage caused a rapid denudation of its slopes, and the consequent formation of a great delta on the west side of the island. The rate at which this delta had been deposited was attested by the natives at Tai-wan-foo. Not many years ago, ships could lie at anchor a mile or two miles from the coast there: at the present time they could not approach nearer than three or four miles. When the Dutch occupied the island—about the middle of the 17th century—Tai-wan-foo had a spacious harbour, referred to in the Dutch accounts, but it was now entirely silted up, and the distance from the former position of the harbour to the available anchorage was at present four or five miles.

The PRESIDENT said, when he was Her Majesty's Minister in China, he visited Formosa, and was very much struck by the luxuriance of its tropical vegetation. He believed that Mr. Veitch, and other botanists, had enriched our greenhouses with many beautiful orchids, and ornamental plants that they or their collectors had brought home from thence. When visiting the southern port, noticing that pine-apples were plentiful, he asked the Consul to send to the market to get a basketful, which he thought he might perhaps succeed in carrying to Peking, a voyage of ten or twelve days. The Consul said he need not send to the market, for one of his coolies could go out into the lane and gather them, as they grew wild, and had no money value. He did not know that they were equal to English hot-house pine-apples, but they were fine in growth and very pleasant to eat in that warm climate. Formosa would undoubtedly become a place of some importance, if it ever pleased God to give it anything like a decent government, and if colonisation advanced into the interior. At present it was merely fringed by settlers of the worst class of coast Chinese. It was badly governed by the officials sent there; but there was a middle class between the Chinese and the wild savages, who were semi-civilised, and would live peaceably if the Chinese officials on the coast, and the head-hunting barbarians in the interior, would give them the opportunity. At present, however, they passed rather an uneasy life. The climate was tropical, and although it had been contended that Europeans did not die more rapidly there than in other places, that was because they went away when they were likely to die. The English Consul in the north told him that it was very pleasant when the weather was fine, but that it rained incessantly for six months in the year. The island was rich in coal, which in the north was now worked with European machinery. This was likely to prove of very great advantage to steamers, and to the whole of the Strait trade on that coast. China also had an incalculable wealth in coal, but hitherto the Govern-

ment had not seen its way to allow it to be worked. If the experiment, begun in the *corpore vile* of Formosa, succeeded, it might encourage them to proceed in a similar way on the mainland. The information obtained from time to time about Formosa showed that everything there was in its infancy. Rice, camphor, wheat, coffee, tobacco, tea, and sugar were all grown there: and no doubt other tropical produce would thrive, if there was a good government and colonists were encouraged to settle. As far as Europeans were concerned, however, he might say of it, as the Irishman said of Ireland, that it was the finest if not the healthiest country in the world—to live out of.

The following Paper was taken as read:—

3.—*A Trip into the Interior of Formosa.* By T. L. BULLOCK.

[ABRIDGMENT.]

WE started from Taiwanfoo, the capital of the island, in the month of October, 1873; the party consisting of Mr. Campbell, a missionary going to visit his native converts, Mr. Steere, an American naturalist, and myself, with our servants and porters.

For three days we marched in first a northerly and then a north-easterly direction across the flat and fertile plain, inhabited exclusively by Chinese, which forms the western part of the island. The third evening, just at the conclusion of our day's journey, we mounted a number of steep steps on to a platform or terrace, stretching out some distance from the hills. We were now passing from the plain country into the mountain district; and the part we were entering had never been visited by any foreigners except Mr. Campbell and a brother missionary.

The next day we travelled eastwards up a stony valley, which ran far into the mountains, continually fording the net-work of streams which descended it. In the afternoon we mounted a high and steep hill towards the north, covered with brushwood and long grass. As soon as we commenced the ascent our party was required to keep together and not straggle, as we had arrived in the country infested by the wild savages, though their nearest villages are many miles away.

When we crossed the ridge of the hill we entered suddenly upon another world. Before us lay a succession of peaks, of valleys, of mountain-sides, all covered with the bright green foliage of a dense forest. Between the trees there grew a profusion of plants, some with giant leaves, others with long leaflets, ferns and tree-ferns, and feathery bamboos. We passed the night in a small Chinese settlement in a neighbouring valley.

Next morning an hour or two's walk through the forest brought us to a small lake. Here we dismissed our Chinese porters, who were to return to Taiwanfoo with the first party they found leaving

the mountains ; and we ourselves embarked in two canoes, and were paddled down to the village at the further end. The lake is crescent-shaped, about three miles long, with numerous little bays or indentations between the spurs that run down from the mountains. The mountains are steep and high, and wooded from the base to the summit. At the head of the bays there are little patches of flat ground, irrigated by the mountain-streams, and cultivated with rice. There are also a few spots on the more gentle slopes, where tea and rice and sweet potatoes are grown in small clearings. A certain number of Chinamen live round the lake, and a small tribe of savages, called by the Chinese Tsui-hwan, or "water-savages." The tribe is now very small, consisting of between 100 and 200 families. It has its own customs, language, and dress : and it is said by tradition to have been once much more numerous and powerful than now, and to have possessed a considerable tract of country. The aborigines of Formosa are divided broadly into wild savages and friendly savages. The former are the inhabitants of the higher mountains, whose hand is against every man : the latter those dwelling on the edge of the plain, and near to the Chinese, who are inoffensive, and are too civilised to really deserve the name of savages. The Tsui-hwan, excepting that they live at peace with their neighbours, deserve to be classed among the wild rather than the friendly aborigines. They are a good-looking and well-made race, without being very tall or powerful, and are fat and healthy. Their skin is of a light reddish-brown colour. Their hair is long, black, and straight. The women are quiet, happy, and pleasant-looking. Their hair is parted in the middle, thrown back, and tied behind. The favourite occupation of the Tsui-hwan is hunting. Every man can handle a gun, which, however, only the richer possess, and a bow and arrow. They carry a long, pointed knife, thick and heavy enough to be used as a chopper. I found afterwards that it was the custom of all the aborigines, of whatever tribe, to carry a knife of this kind. They have various modes of fishing, among others, one by torchlight : but they did not employ it at the season when we were at the lake. We once saw a man fishing from a canoe with a bow and arrow, and a fish he had just caught. The head of the arrow was like a four-pointed fork. They also employ themselves to some small extent in tilling the land, either for themselves or for their Chinese neighbours, who now possess the greater part of that which is cultivable round the lake. Their houses are built of wood, and consist only of one large and high room, which is inhabited by several families, or perhaps by several couples belonging to the same family.

With the help of a few native men and boys, we compiled a list of words in their language. I afterwards compared this and some similar lists, obtained at different times, in other Formosan languages, with some lists of words in various Malay languages, and found a very large number of words identical or resembling in the two.

The next morning we started off, and travelled in a northerly direction for about 15 miles. The path lay along the valleys, crossing no high pass, but with many short and steep ascents and descents. The country was entirely covered with forest, excepting a few of the wider valleys, which had been cleared by Chinese settlers and planted with rice. The end of our day's journey was at a place called Posia, where we took up our abode in the little Mission-house of a Christian community.

Posia is a flat oval plain, about five miles long and four broad, surrounded by the mountains on all sides. From the western end of it one sees towards the east the lofty peaks of the great central range, 10,000 to 12,000 feet high; and from the eastern end one sees line upon line of hills far away to the west, showing how far one has penetrated into the mountains. There are a good many Chinese living in the various villages of Posia; but the bulk of the population, some two or three thousand, are aborigines, belonging almost entirely to the tribe called Sek-hwan, a name composed of two words meaning tame or friendly savages. The Sek-hwan, in point of civilisation, are equal to the lower orders of Chinese, but are more simple and less cunning. Having lived outside the mountains on the edge of the plain before they migrated comparatively recently to Posia, they must have been in close intercourse with the Chinese during some centuries. They subsist principally by agriculture; but though tolerably good farmers, they are not in this respect the equal of the Chinese. They are passionately fond of hunting, which they pursue sometimes singly, sometimes in large parties, whenever they have the necessary leisure. The game they kill consists of three kinds of deer, wild boar, squirrels, monkeys, pheasants, flying squirrels, and occasionally panthers and wild cats. Fortunately for themselves, they have no taste for opium; but they are fond of wine and spirits, in both these points resembling the rest of the aborigines of the island. The rice-wine, however, which they make is so weak that they very seldom become intoxicated. In appearance they differ considerably from any other aborigines that I have seen in Formosa. They are taller, slighter, and rather fairer. They have large dark eyes, and wide mouths, with long and projecting upper teeth. The men wear short trousers

and jackets, differing but very little from those worn by the Chinese. Their hair is tied in a knot at the back of the head, after the fashion of the Chinese before the introduction of pig-tails by the present dynasty. The women fasten their back hair in a knot and comb the front hair down over the forehead, cutting it in a line just above the eyes.

The English Presbyterian missionaries have met with great success among the Sek-hwan of Posia. Though the Mission has been opened but a short time, there are sixty baptized Christians, and about four hundred regular hearers.

A long day's march to the east of Posia, high up on the mountains of the central range, lie the villages of the Boo-hwan, a large tribe of wild savages. When they are at peace with the inhabitants of Posia, that is to say, when they have not murdered any of the latter very lately, a small amount of intercourse is kept up between the two districts. Some two or three Sek-hwan traders, who are well known to the Boo-hwan and speak their language, are allowed to go into the villages of the latter to trade; and a few of the Boo-hwan come down to the border-villages of Posia for the same purpose. The articles brought down by the Boo-hwan are principally skins and deer-horns, and pieces of grass-cloth and embroidery, which they exchange for gunpowder, salt, red calico, and iron work.

After many days' delay, we prevailed on the trader who had interpreted for Mr. Campbell to accompany us on a visit to their people. Our party consisted of our three selves, the interpreter, two porters, a servant, and a Boo-hwan woman, married to a Sek-hwan of Posia. Though we had two porters we had hardly any baggage, as the country was too rough for a man to be able to carry more than a few pounds. Our route lay due east, up a long valley with steep and lofty sides; that to the south covered with dense and almost impenetrable forest, full of prickly climbing plants; that to the north covered with high grass, and a few pines and oaks. After a short day's march we arrived at some small clearings and cultivated patches, with a few temporary huts. The one or two Boo-hwan living there declined to take us on to the villages, but offered us a night's lodging. As the hour was late, we accepted the offer. A few pieces of sweet potato and taro, and a mess of pounded rice and millet, were given us for dinner. The hut allotted to us being too small to accommodate all our party, and very dirty, we gave it up to our servants, and slept on the hill-side under a small granary raised on posts about 3 feet from the ground. The next morning after breakfast the native woman

went back, and the rest of us continued our journey. The valley soon narrowed into a deep gorge, with no semblance of a path, up which we scrambled along the rocks or through the water as best we could. After midday we halted and ate a little rice, and then commenced the ascent of a long and extremely steep hill, halting frequently to rest the porters. On a plateau near the top we passed a few patches of millet, and one of China grass; and we could see similar plots dotting the upper part of the hills on the opposite side of the valley. At last we reached the summit, and found ourselves in a village situated on the ridge of the central range, perhaps some 5000 feet above the sea. At first there were not many people about: but those we saw received us in a friendly, though not in a cordial, manner. Not long after we arrived, when strolling about the village and looking at what was to be seen, we discovered a row of skulls laid out on a raised board in front of one of the houses. There were no less than twenty-five of them, a few not yet bleached, others evidently many years old. We paid a good deal of attention to this display, and one of the party sat down and took a sketch of it. This, and our staring, put the savages into a bad and suspicious temper, which frightened our guide, who insisted upon our sitting down quietly instead of looking about. Our servant now became so terrified, either at what the guide said or at the looks of the savages, that he became perfectly useless, and was only fit to sit in a dark corner during the remainder of our visit. We took a seat in front of one of the houses, and, to produce a better impression, we brought out some packets of needles and made presents from them to the women. Some men who had wounds or sores now applied to us for medical aid. Having a bottle of iodine, we painted the wounds with it, to the great satisfaction of our patients. After a time we went to have a look over the back of the hill towards the east. We saw a long valley running in that direction, and then more mountains: but we were too much shut in to see the sea, or to get a very extended view. One of our party wandered a little way off into a neighbouring grove, which was used for a cemetery; and cries of horror were raised when his presence in it was discovered. On his return a small quantity of dust was poured on his head to purge him. One of the savages gave up to us his hut for the night, and after dinner we had a large audience of both sexes and all ages. The room was lighted by the fire and by knots of resinous pine burnt on a low stool. More men came to have their wounds dressed. Indeed, nearly every man in the village seemed to have abrasions of the skin somewhere. All who liked were allowed to smell at a

bottle of ammonia. The extremely energetic way in which they showed their astonishment afforded the greatest amusement to the lookers-on, and everyone seemed to be in the best of humours again.

Next morning we made various presents in recompense for our entertainment, and set off in good time upon our homeward journey. We descended the big hill in less than a quarter of the time we took to ascend it, and soon afterwards came upon a small party of armed savages sitting in the road, who got up and followed us. Then a few more overtook us from behind; then a few descended the hill on our left, then some on our right; then we came on a chief and a stronger party. All we saw joined company with us; till at last we were marching along surrounded by thirty or forty men in war-dress, and armed with spear and knife. As they did not seem particularly friendly, matters looked rather unpleasant, and we did not know what might be coming. We tried to let them get ahead of us: but when we loitered, they did the same: so we had nothing to do but go on steadily. Our guide spoke neither to us nor to them, but led the way in front of everyone, walking fast. At length, when we had got past their last clearing, but were still some miles from the edge of what they consider their territory, some of them began to drop behind, and in a little while the main body halted, while we continued our march alone. We reached Posia shortly before dark, after nearly nine hours' hard walking.

The Boo-hwan savages are of small stature, with good chests and shoulders, but their muscles, excepting those of the legs and thighs, are very little developed. Their faces are pleasing, rather mild than fierce, generally intelligent-looking, and not unfrequently handsome. The wild savages I have seen of two or three other Formosan tribes further south are of a darker red, and of a coarser and less agreeable appearance. In warm weather they wear absolutely no clothes, but some have a small handkerchief tied round the waist with the ends hanging loose in front. They are tattooed across the lower part of the face, with a broad band of net-work passing from the ears under the nose and covering the chin. They have also a few small marks on the forehead, made when they are children. The broad band is tattooed at marriage. The men have a line an inch broad down the forehead and continued on the chin. The women weave a strong and useful kind of canvas from China grass. They also make some rather tasteful embroidery, taking the canvas for a base, and unravelling blue or red calico to obtain the thread for working with. Their houses, which are built of flat stones



without mortar, consist of one large room. The floor is two or three feet below the level of the soil. They have no window and a small door, so that they are very dark even in the daytime.

The wild savages in Formosa seem to carry on the practice of man-hunting out of mere devilry and for the sake of obtaining skulls. They kill all alike, Chinese and aborigines, except those of any tribe with whom they may be anxious to keep on good terms at the moment. They leave home in parties of generally from ten to twenty, armed with spears and knives, not with guns, and carrying a small bag of boiled rice on their backs. They sometimes go for as much as two or three days' march till they reach the edge of the frequented spots. Here they lurk about the forest, sometimes cutting off a man working alone in his field, sometimes falling upon a band of travellers whom they are strong enough to master. They never attack unless they think themselves the strongest, and, so thick is the forest, they never show themselves but at the moment of attacking. When their provisions are exhausted, or they have obtained a head, they return home. In the latter case a feast is organised. The skull is roughly cleared out; wine is poured in, and it is handed round for the company to drink from.

Two days after our return to Posia we started on our homeward journey, going due west, and taking the usual road of communication between Posia and the plain.

*Ninth Meeting, 26th March, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*James Coate, Esq.*

ELECTIONS.—*Hon. Cecil Ashley; Jonabad Finch, Esq.; Alfred William Goodman, Esq.; John Griffin, Esq.; Cornelius Herz, Esq.; Robert George Lutley, Esq.; James Macalister, Esq.; John William Reed, Esq.; Edwin J. Richardson, Esq.; Henry Robertson, Esq., M.P.; John Rutson, Esq.; James Benjamin Scott, Esq.*

DONATIONS TO THE LIBRARY, 12TH TO 26TH MARCH, 1877.—The political economy of Indian famines, by A. H. Browne; Bombay, 1877 (*Author*). South Australia; Proceedings of the Hon. THOS. Elder's expedition under command of Ernest Giles, from Perth to Adelaide, 1875-6 (*The Governor of Victoria, per H.M. Under-Secretary of State for Colonies*). Verslag over de Voorwerpen door de Neder-

landsche Zeevaarders na hunne Overwintering op Nowaja-Semlja, &c., door J. K. K. de Jonge, with photograph of relics of Barentz discovered by Charles Gardiner, Esq.; s'Gravenhage, 1877 (*His Excellency W. F. Van Erp Taalman Kip, Netherlands Minister of Marine*). Annaes da Comissão Central permanente de Geographia, No. 1, Dec. 1876 (*The Central Committee of Geography, Lisbon*). Archivos do Museu Nacional do Rio de Janeiro, vol. i., pts. 1-3 (*The National Museum, per M. Ladisláu Netto*). Notes on the country between Kilwa and Tanganika, by James Stevenson; Glasgow, 1877 (*Author*). Indberetning om den af Prof. Johnstrup foretagne Undersøgelsesreise paa Island, 1876, and Om Grönsandet i Sjælland, af F. Johnstrup; Kjöbenhavn, 1876 (*Admiral Irminger*). Select plants eligible for culture in Victoria, by Baron F. von Mueller; Melbourne, 1876 (*Author, on behalf of the Victorian Government*). Remarks on recent Ocean explorations and the current-creating action of Vis-inertiæ in the Ocean, by W. L. Jordan, 1877 (*Author*). Three Grammars and vocabularies of the Yoruba language, 1843-52, and one of the Nupe language, 1864, by Samuel Crowther; Vocabularies, &c., of Six East-African languages, and of the Kisuáheli, Wakuañi, and Galla languages, by J. L. Krapf, 1842-50; Grammars of the Vei and Bornu languages, by S. W. Koelle, 1854; Grammar of the Ibo language, 1861, and Vocabulary and Dictionary of the Hausa language, 1843 and 1876, by J. F. Schön; Vocabulary of the Masai-tribes language, by J. Erhardt, 1857; Grammar of the Temne language, by C. F. Schlenker, 1864; Grammar of the Amharic language, by C. W. Isenberg, 1842; and Grammar of the Fulde language, by C. A. L. Reichardt, 1876 (*The Church Missionary Society, per E. Hutchinson, Esq., F.R.G.S.*); and the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO MAP-ROOM, MARCH 12TH TO 26TH, 1877.—Eleven maps from Petermann's Geographische Mittheilungen (*Dr. A. Petermann*). Map of Tierra del Fuego, showing track of M. Pertuiset (*M. Pertuiset*). 602 sheets of Ordnance Surveys of Great Britain on various scales, and 57 Area Books of Parishes (*First Commissioner of H.M. Works and Public Buildings, through Major-General Cameron, Director of Ordnance Survey*).

The PRESIDENT, before proceeding to the immediate business of the evening, alluded to the great loss which the Society had sustained by the death of Admiral Sir Edward Belcher. He was one of the oldest Fellows of the Society, and for half a century was distinguished as a scientific navigator and nautical surveyor. He was associated with some of the early explorations in the Arctic Circle, and some years later commanded one of the expeditions which were sent in search of Sir John Franklin. About twenty or thirty years ago he (Sir Rutherford) met him in China, and in fact there was no

coast in any quarter of the world where he had not done valuable work, and proved his scientific accuracy, and the laborious mode in which he carried out his surveys. Such men were not easily replaced. There were but few in a generation, and when one of them passed away, those who knew what they had done were bound to pay them the tribute of affectionate regret.

The special business of the evening was the Paper that had been announced on Smith Sound by Captain Sir George Nares. When the Society first gave a cordial welcome to the officers of the Arctic Expedition at St James's Hall, they were informed that as it would be impossible on that occasion to enter into any discussion, another opportunity would be afforded for Members who were inclined to discuss the geographical results that had been achieved. The present evening had been therefore set apart for that purpose.

The following Paper was read :—

*On the Navigation of Smith Sound, as a Route to the Polar Sea.*

By Capt. Sir G. S. NARES, R.N., K.C.B.

My present Paper on the navigation of Smith Sound will, I trust, be accepted as a continuation of the one on the Polar Area, which I recently had the honour of reading before this Society; rather than as being in itself an exhaustive description of the locality.

Our knowledge of the water-passage leading from Baffin Bay to the northward into the Polar Ocean, is derived from observations made by explorers who have passed eleven summers and six winters in the neighbourhood.

Of the four Expeditions specially equipped for the exploration of Smith Sound, three were despatched from the United States and one from this country.

In 1852, the present Admiral Inglefield visited the entrance of the Sound, and discovered the south shore of Grinnell Land; also that the coast of Greenland, north of Cape Alexander, trended to the north-east for a considerable distance, but he did not land on either shore.

In 1853, Dr. Kane, with his small sailing-vessel, was the first who succeeded in forcing a passage within the sea; but, after a most determined and spirited struggle, he was finally imprisoned by the ice in Reusslaer Bay for two winters. From there one of his sledge-parties, under Morton, explored the Greenland shores to Cape Constitution; and another, under Dr. Hayes, landed on Grinnell Land; both journeys displaying the very highest qualities in all engaged in them.

He was followed in 1860 by Dr. Hayes, who, unable in his sailing-schooner to enter the sea, was forced to winter in Port Foulke.

In the following spring, after a most harassing and determined march across the heavy Polar pack in Kane Sea—over which he

found it impossible to drag his boat—he ascended Kennedy Channel; making one of the most brilliant Arctic sledge-journeys on record.

In 1871, Captain Hall, in a small steam-vessel, made his very successful run to the head of Robeson Channel, where he was stopped by ice, and forced to winter in Polaris Bay.

From thence, sledge parties explored to the northward of Newman Bay; but, like all previous travellers except Sir Edward Parry, they were unable to drag their navigable boats over the rough ice. On her return voyage, the *Polaris* was caught in the pack and driven into Lifeboat Cove, where she was obliged to be run on shore.

In 1875, the most powerful Expedition of all, consisting of two steam-vessels, admirably equipped, was sent out from this country under my command.

We succeeded in reaching the head of Robeson Channel, where we were stopped by the ice, and passed the winter on the west shore of the channel.

Sledge-parties explored the whole of the neighbouring shores, and determined the existence of an extensive sea; but, like all our predecessors, we were unable to transport navigable boats for any great distance across the ice, away from the land, during the short season when exploration by means of sledging is possible.

The coast of Greenland bordering Smith Sound, so far as can be sighted from the sea, lies completely imbedded in ice—in summer as well as in winter—without one mountain-peak showing itself above the very slightly inclined skyline of perpetual ice.

The glaciers descending from this ice-cap are, however, mostly melted before reaching the coast, leaving a border of land clear of ice near the sea.

Hartstene Bay, situated at the head of Baffin Bay, on the Greenland shore, is washed by a warm current coming from the southward; and is protected from the cold Arctic flow by the projecting promontories, which form the western capes of Greenland. In consequence, the neighbourhood, as first pointed out by Dr. Hayes, enjoys a comparatively mild climate; and on the vegetated lands fronting the ice-cap, as well as in the neighbouring sea, Arctic life is found in its greatest abundance.

As experience shows that, in all but very exceptional seasons, the position can be yearly visited from the southward, the neighbourhood forms a valuable and important base for exploration in more northern latitudes. It is, in fact, the most northerly position, where an abundance of game is procurable by experienced hunters

within a restricted area. At no other northern position yet explored is game now to be obtained in sufficient quantities to enable even a party of Eskimo to exist throughout the year on their own resources.

On the opposite coast of Ellesmere Land, on the west side of the channel, the country in the interior is not so completely buried in ice as the Greenland hills, and the mountain-tops all project above the ice-cap.

South of Cape Sabine, the glaciers on the hill-sides extend into the sea, and few bare places are left fit for feeding-grounds; but northward of it, along the southern shores of Hayes Sound, the line of perpetual snow and ice—as on the Greenland coast—is at a considerable height above the sea-level; consequently the glaciers, instead of extending to the sea, are fronted by vegetated valleys, and heights free from ice.

One spot partially explored by the late Expedition—Twin Glacier Valley and the heights about Alexandra Haven—exhibited many recent traces of Arctic life; and the numerous ancient Eskimo remains found there would denote that game had always frequented the neighbourhood.

An exploring party travelling up the Sound, on the interesting duty of ascertaining whether a water-passage exists extending to the Western Sea, may therefore expect to obtain a small supply of fresh food on the south coast of Grinnell Land. North of Hayes Sound, the mountains are remarkably free of any ice-cap; the valleys contain small glaciers; but extensive tracts of land are free from snow during the short summer, yet the locality is decidedly unfavoured by game. While our ships were detained by the ice near the coast, only a few hares and ptarmigan were obtained. Sledge-travellers will be unusually fortunate if they there obtain any game at all.

In Rawlings Bay, at the south entrance to Kennedy Channel, a few ancient decayed musk-ox bones were found; but I think that few of these animals wander so far away from the more favoured grazing-grounds in the large valleys near Mount Grant, in the United States Range. As we advance to the northward, up Kennedy Channel, the sea-life rapidly diminishes, and the bears who prey upon it are found in ever-decreasing numbers. At Polaris Bay, where the winds and currents contribute to keep the water-spaces more open than elsewhere, a few seals and sea-birds congregate during the summer. North of Robeson Channel, few, even of these, are met with, and the bears and dovekies are quite left behind.

Throughout the whole area north of Smith Sound the migratory

birds in small numbers rear their young in the favoured valleys and plains during the short summer.

The nearer we approach the Pole, the later in the season does the sun make its appearance, and the lower the altitude it attains at noon. Consequently, the spring and the reanimation of the non-migratory Arctic life are more backward than in more southern latitudes.

At the Pole, the birds can have very little time to spare between the late spring and the returning autumn frosts in which to rear their young. So pressed are they for time that, as I have already related, many that visited Floeberg Beach, finding the season more backward than they anticipated, were obliged to return to a more favoured locality farther south. Thus I reason, that as we advance to the northward, less dependence can be placed on obtaining an appreciable supply of winged fowl.

With regard to migratory birds in high northern latitudes, it is remarkable that the men of our party who resided at Polaris Bay during July and August, the best season for game, and who were extremely anxious to obtain a supply for the use of their sick comrades, were unable to find birds in as great numbers as the crew of the *Polaris* had found them at the same place. And I cannot but conclude that the birds resort yearly to the same locality for the purpose of breeding, and that when they are all shot down in any one neighbourhood, it takes some years before that neighbourhood becomes fully stocked with game again. This opens up the question as to whether the large number of necessarily ruthless sportsmen who last year hunted the district between Lady Franklin Sound and Cape Joseph Henry have not for a time devastated that district by destroying all the parent birds.

The same consideration will apply to musk-oxen; for Hans, the Eskimo, who was the most successful hunter on board the *Polaris* in 1872, could find none of those animals on the same feeding-grounds in 1876.

It will be convenient if we consider the district under discussion as consisting of two narrow channels, Robeson and Kennedy Channels; and two broadened parts or seas, Hall Basin and Kane Sea, with Smith Sound or Strait as an outlet into Baffin Bay. During the navigable season, that is during August and the first week of September, after the ice has broken up, and is drifting about at the mercy of the winds and currents, in consequence of the prevailing winds coming from the westward and the ocean-current from the northward, the shores of the channels and seas having a north-westerly aspect are more liable to be encumbered

with ice for long periods than those with a southerly or easterly one. This consideration, coupled with the knowledge that Dr. Kane, although working with remarkable patience and perseverance, was unable to force his way beyond Reusslaer Bay, on the south-east shore of Kane Sea, and was imprisoned there the following season, owing to the ice in the neighbourhood never permitting him to move, determined me, both when going North and returning, to keep on the western shores as much as possible.

In a channel of varying breadth, owing to the strength of the winds, tides, and ocean-currents being greater in the contracted than in the broad channels, the ice is more readily carried away out of the narrows and deposited in the more sluggish waters of the broadened parts.

Thus, in Kennedy Channel, there is comparatively a free navigation throughout the summer; while in Kane Sea there is a great accumulation of ice, with a constant influx at the north end, and a discharge into Baffin Bay at the southern entrance. At the latter point, where the ice is first met with when coming from the southward, as the current runs stronger in the offing than inshore; the southern edge of the ice, extending across from Cape Sabine towards Littleton Island, assumes a horse-shoe shape, curving to the northward, with a water-space in mid-channel, from whence the ice is readily carried to the southward. Thus, vessels arriving from Baffin Bay are usually able to penetrate for a short distance farther north in this bight than they can do by keeping among the more closely-packed ice inshore; but they are sure sooner or later to meet the southern edge of the main pack-ice in Kane Sea. It can only be in very rare seasons that the water-bight can extend so far north as to communicate with the more open sea in Kennedy Channel.

It is a mistake to suppose that the *Polaris* did not encounter ice in this part as she ran to the northward. From a position near Littleton Island, she steered a direct course for Cape Fraser; but found that she was running into a bight in the ice. Captain Hall then turned to the south-west, and, rounding the edge of the pack, passed up to the northward close along the western shore, through a water-channel existing between the pack and the land, in the same manner as the *Alert* and *Discovery* did; the only difference being that while we had to fight for every mile, the *Polaris* fortunately found a continuous channel, probably owing to a previous westerly wind.

In Hall Basin there is an accumulation of ice similar to that in Kane Sea, with a few open-water spaces in the narrowest part of

Robeson Channel. But the large stores of ice in the Polar Sea to the northward, and in Lady Franklin Sound to the westward, readily movable by the prevailing wind, renders the navigation of this part even more difficult and dangerous than in the larger but somewhat similar Kennedy Channel.

In conducting a vessel to the northward, the greatest difficulties may be looked for when passing along the shores where the pressure of the current sets against the land. This is particularly the case near the southern exit to the two broad seas, Hall Basin and Kane Sea. Happily both are furnished with good and convenient harbours.

Cape Sabine, a difficult point to pass, has Port Payer most advantageously situated for use as a resting-station while waiting for a westerly wind to blow the ice out of Hayes Sound and open a passage to Victoria Head and to Grinnell Land. If stopped on the way by the ice, the grounded icebergs in the indentation on the east side of Bache Island will afford a slight amount of protection; but, after leaving Port Payer, Norman Lockyer Island and Walrus Shoal are the only secure resting-places until Bessels Bay or Discovery Bay is reached; both of which are valuable harbours, although the former is much encumbered by icebergs.

The open bays on the south-east coast of Grinnell Land, owing to their large size, afford very little protection to a ship. In the early season they are generally filled with one season's ice of ordinary thickness, in which a dock may be cut when the ship is compelled to wait; but by the middle of August, the height of the navigable season, this bay-ice has generally broken up and drifted out, giving place, when the wind blows on shore, to the heavy Polar ice from the main channel.

Wherever large icebergs have grounded in clusters near the land—as is the case inside Washington Irving Island, north of Hayes Point, and in Joiner Bay—if the ice inshore of them has broken up and drifted out of the way, they often afford convenient protection from immediate danger when the outer ice closes in. At other parts, such as Maury Bay, small ones become stranded, and are useful as fixed stations to which the ship may be temporarily secured; but if the outer ice closes in with force, both the ship and iceberg or floeberg, whichever it might be, would be forced upon the shore. With this consideration, a light draught of water is of the utmost importance in an Arctic vessel.

North of Baffin Bay, ice-saws are only of use when meeting with the one season's icefloes of from 3 to 6 feet in thickness, which have been formed in the bays during the previous winter. The



usual saw is far too short to make any impression on the thick ice found in the main channel, most of which has drifted to the southward out of the Polar Ocean.

Also, as steamers are called upon to navigate through very close ice and through channels only as broad as themselves, there is very little time given to think of docking; the greatest judgment is required by whoever is in command; and the danger of the ice nipping together must be somewhat disregarded, if any advance at all is desired.

To the northward of Cape Sabine, the only discharging glaciers are those in Dobbin Bay and Rawlings Bay on the Grinnell shore: and in Peabody Bay and Bessels Bay on the Greenland coast. The icebergs broken off from the front of the discharging glacier which completely fills up Petermann Fiord are so small, that it cannot be considered as in any way affecting the navigation of the district. In Robeson Channel, and in the Polar Ocean to the northward immediately in its neighbourhood, there are no icebergs. Of those which escape out of Bessels Bay, a few drift towards the north, and become stranded in Polaris Bay, where one sheltered the *Polaris* during her winter stay. The greater number drift at once to the southward through Kennedy Channel, without grounding, owing to the depth of the water and the strength of the current. There are few icebergs met with in mid-channel north of latitude  $80^{\circ}$  N. South of Rawlings Bay, where the channel expands into Kane Sea, they become stranded, and stud the shores on both sides. A navigator passing a cluster of these carefully notices the amount of protection it would be capable of affording, were he forced to retreat by the ice closing in ahead.

Kane Sea is thickly studded with floating icebergs. All the large ones derive their birth from the Humboldt Glacier, and their drift readily marks the general movement of the ice. From the high land about Cape Louis Napoleon, 2000 feet above the sea, the heavy chain of bergs in Peabody Bay fronting the Humboldt Glacier—through which Morton from Dr. Kane's vessel had such difficulty in advancing when making his splendid journey to the north—is distinctly visible at about 50 miles' distance. A few of these drift across to the western shore, but the majority are carried to the southward on the east side of the channel. On all occasions those which are driven into the offing indicate the faster drift of the main body of the ice in mid-channel compared with that nearer the shore. This is also well shown by the drift of the *Polaris*. Caught by the pack and borne onward by the full strength of this current, she drifted from the south entrance of

Kennedy Channel, in an almost direct line, to the neighbourhood of Littleton Island—between the middle of August and October—a distance of 120 miles in sixty days. Her drift also shows that, although all regular navigation is over for the season by the middle of September, the ice is not firmly frozen before October or November; but after the latter month all motion ceases except in the very narrow channels.

A strong current, even when the temperature of the water is very low, is a powerful agent in retarding the formation of ice, and in preventing ice once formed increasing in thickness as fast as it would if the water were stationary. It also decays and destroys the ice before the power of the sun is able to make itself felt.

In Bellet Straits, leading westward out of Prince Regent's Inlet, where the tide runs with great rapidity, Sir Leopold McClintock informs us that the water remains unfrozen throughout the winter. In other narrow channels the ice only attains a minimum thickness, even during the coldest weather. Early in the spring, long before the temperature rises above the freezing-point, the ice in the narrows decays and polynias are formed surrounded by fixed firm ice.

I therefore reason that because Robeson Channel was open nearly all the winter of 1871-72, it does not necessarily follow that the ice in the Arctic Sea was also in motion at the same time; and yet I cannot take upon myself the responsibility of suggesting that the ice in that sea always remains unbroken and quiet as late in the season as it did last spring, that is, until the middle of July. Were we perfectly certain that the ice in the Polar Ocean always remains stationary until even the end of June, sledges unprovided with boats might be despatched towards the north, and the possibility of reaching a higher latitude would then be very considerably increased.

It must be gratifying to all interested in Arctic matters to hear that in the United States it is contemplated to send out another Arctic Expedition to extend our knowledge of these seas, which may be said to peculiarly belong to themselves. There is still a wide field there for geographical and scientific research; but I am afraid that great difficulty will be found in advancing much nearer to the Pole by the Smith Sound route than has already been attained, either in a ship, or by boat, or sledges, unless, indeed, the coast of Greenland—contrary to my expectations—trends to the northward beyond lat.  $83^{\circ} 20' N$ .

Admiral Sir RICHARD COLLINSON said his experience of the Arctic Regions had been confined to a different part from Smith Sound, but there were some statements in the interesting Paper which had just been read, which he could

corroborate from what he had himself seen. Many years ago Captain Parry pointed out that in order to explore the Arctic Regions it was necessary to stick to the land; never had that been more strongly proved than by the late Expedition. Not only must the explorers stick to the land, but, as Sir George Nares had said, they must find out which was the weather shore. The Paper had referred to the fact, that in certain portions of the Arctic Regions animal life was so rare that probably one or two expeditions would completely exhaust it. His own experience confirmed that view. Sir Robert McClure, Captain Parry, and Captain Kellett found musk-oxen and deer in abundance on Melville Island, and the north end of Banks Land, but he (Admiral Collinson) following the coast of America, and being continually in the neighbourhood of the Eskimo, though much further south, only saw one live musk-ox, and obtained but a small number of deer. It would therefore be a mistake for future travellers to expect that they would be able to support themselves on fresh meat. The occurrence of pools of water in some places, and the continual motion of the ice was a most interesting fact, and one which must be well studied by any succeeding explorers in the Arctic Ocean. Baron Wrangel, proceeding to the northward of Siberia, came upon water in the early spring, and was prevented from continuing his journey by the sledges falling through the ice. On the other hand, during the winter he (Admiral Collinson) spent on the north coast of America he never saw a single crack or movement of the ice. It was difficult to account for the open water in the regions north of Siberia, which were supposed to be the most inclement part of the world. Wherever there was a projecting headland, such as Point Barrow, and the coast trended away, the ice, affected by the water of the spring-tides, and by the wind, broke off. This accounted for the presence of open water which was frequently seen by H.M.S. *Flover* during the winters which she spent there, and it had led people to believe in the existence of what were sometimes called polynia. The term polynia, however, merely meant an open hole extending for a short distance. If any attempt were made to go through the ice because of the presence of these holes, the vessel would get into the same difficulty as the *Tegethoff*, and be entirely dependent upon the current. There was one thing, however, which should always be remembered by Arctic voyagers, and that was that the time of greatest danger was often the very moment of safety.

Admiral RICHARDS, as one of those who were in some sense responsible for the route taken by the late Expedition, said it was very well known before that Expedition sailed that there was a divergence of opinion as to the best means of reaching the Pole; but there was no difference of opinion as to Smith Sound being the best route for such a sledging expedition as was proposed. There had been very good reason to believe that land extended a considerable distance beyond the most northerly point reached by the *Polaris*, and that that land trended northward. Had that been so, there could be no question but that the late Expedition would have reached a much higher northern latitude than it did. If the coast-line, which was explored to the west and to the east, were turned north, it would extend nearly to the Pole. It must, however, be admitted now that if the discoveries of the *Alert* and the *Discovery* had been known previously, those vessels would certainly not have been sent to Smith Sound, because every Arctic traveller knew perfectly well that it was quite impossible for sledge-journeys to be carried out to any great extent where there was no land along which the sledges could be dragged. So soon as Sir Geo. Nares found that there was no land to the north, he knew it would be impossible to reach the Pole, and therefore he explored east and west, which was all that was left for him to do. Smith Sound must now be regarded as a closed route to the Pole by sledges, and he knew of no other available sledge-route. He did not say that there would never be any more sledge-

expeditions; but he maintained as strongly as possible that sledge-travelling with a view to reaching the Pole was at an end for ever. The longest distance ever accomplished by any one sledge-party, or by any combination of sledges, in one direction, did not exceed 360 geographical miles in a straight line, and that distance had only been travelled by one party, under exceptionally favourable circumstances. Three other parties had made on the outward journeys about 300 geographical miles. Of course the necessity of deviating from the straight line, to avoid rough ice, made the actual number of miles travelled much greater, but 360 geographical miles was the longest distance ever passed over in a straight line by any sledge-party on their outward journey. Proposals had been made for extending such journeys by means of balloons or steam. The idea of ballooning may be at once dismissed, but the use of steam would appear very feasible to many persons. Steam had overcome all difficulties of locomotion but this one; and if an unlimited extent of ocean solidly frozen over could be found, no doubt a traction-engine could traverse it; in fact, a railway train could go over it easily. But such a solid ocean had never yet been discovered away from the neighbourhood of land, and in fact never could be. He therefore need not say what would be the fate of a traction-engine if it got upon thin ice or into a hole. The Americans appeared to have an intention to colonise Lady Franklin Bay. He wished them success in so original an enterprise, for none were more entitled to it; and if they carried it out, some very remarkable results no doubt would ensue; but he was bound to give a decided opinion that no expedition would ever reach the North Pole, or approach near it, by a sledge-expedition through Smith Sound.

It should be remembered that sledge-travelling was not introduced to discover new land, but rather to search for the missing crews under Sir John Franklin. Such a mode of travelling never would have been adopted to discover new land in the Arctic Regions, at the rate of three or five miles a day. He believed it had been brought to the highest pitch of perfection of which it was capable while human beings were constituted as at present; but it did not follow from what he had said—and he should be very sorry to think it did—that the North Pole could not be reached. Twelve years ago Dr. Petermann, who has been the constant and consistent advocate of reaching the Pole by the Spitzbergen route, communicated his views to the Society in two letters to the President, which were read and printed in the 'Proceedings' of that date. He supported those views by evidence to my mind the most conclusive short of actual experience, that is, by the most industrious and persevering research on the subject of isotherms and other physical phenomena. I see here this evening Arctic officers who were in accord with Dr. Petermann on that occasion, and I repeat what I said then, that no papers I have heard read before the Society on the subject of reaching the Pole have appeared to me so sound, so logical, or so convincing, as those papers of Dr. Petermann's. The subject was a speculative one then, more than it is now; but the papers have stood the test of twelve years, and they force themselves more on my conviction now than they did even then. Briefly, the proposition was that two stout and well found steamers, such as the *Alert* and *Discovery*, should seek an opening through the ice north of Spitzbergen, an attempt which has never yet been made. It is the only route which offers a prospect of success by ships, and it is impossible to deny that it does hold out a very fair prospect. It could be effected in one summer, and if unsuccessful could be resumed the next. It need not involve a winter in the Arctic Regions, though I should much prefer, if necessary, to pass one at Spitzbergen, where it might be spent profitably and not unpleasantly.

Admiral OMMANNEY said, after the very interesting Paper which had just been read, he thought the country had been fully rewarded for the expense of the late Expedition. With regard to geographical results, the termination of

Grant's Land had been ascertained, and perhaps the termination of the great continent of Greenland, while for the first time the real Polar ice-sea, lying between  $80^{\circ}$  and the Pole, had been visited. He did not think that Parry ever came near that great massive ice which has been discovered on this Expedition. He quite agreed with Admiral Richards as to the impracticability of reaching the Pole by sledges; and he believed that the conditions of the North Pole were somewhat similar to those of the South Pole—one huge glacier, the borders of which, however, did not extend into so low a latitude as that in the South Polar Regions. This is the first Expedition that has reached the boundary of the so-named Palæocrystic ice, and he believed that on all future attempts to reach the Pole the same formidable obstacle will be encountered. Captain Nares had alluded to the traces of Eskimo on the western coast of Smith Sound, and the native who was with him (Admiral Ommanney) in the Arctic Seas drew a chart, and showed that his ancestors had visited those shores and found musk-oxen there. He wished to pay his tribute of admiration to Captain Nares for the manner in which he navigated his ships, taking them as far North as there was a drop of water to be found to float them.

Captain FEILDEN said he agreed with Sir George Nares as to the paucity of animal life in those regions, and the probability that the animals which had been seen there were permanent residents. There could be little doubt that the musk-oxen seen in the northern part of Grant's Land remained there continually. There was no more reason why they should not spend the winter there than the reindeer in Spitzbergen, which was nearly as far North. The absence last year of musk-oxen at Hall's Land was probably owing to the *Polaris* crew having killed them all. Evidently at a time not very remote there must have been a much greater amount of animal life in Smith Sound than at present, because at various localities, such as Rawlings Bay and Hayes Sound, remains of large Eskimo settlements were found, having the roofs of the huts made of the skeletons of large whales and cetaceans that at one time must have penetrated Smith Sound, though during the late Expedition no trace of them was seen. Beyond Cape Union one of the sledging-parties picked up a tusk, or canine tooth, of a narwhal, which animal certainly did not come through Robeson Channel at the present date, and he also procured a rib-bone of some large whale. It was therefore probable that there had been an alteration in the climate since the Eskimo inhabited those villages which were now deserted.

The PRESIDENT: Have you any data as to the time when the Eskimo were settled there?

Captain FEILDEN said all he could safely say was that it must have been at a very ancient date, for the bone remains which had been used for sledges were often quite exfoliated from age and exposure, and there were no recent traces of any kind.

Dr. RAE, referring to Admiral Richards' statement, that if Captain Beaumont's wonderful journey were joined to that by Captain Aldrich, and extended northwards, it would almost reach the Pole, said that the total distance travelled by those two explorers in a straight line was not more than 260 geographical miles, while from the winter quarters of the *Alert* to the Pole was 460 geographical miles; a difference of 200 miles each way, or 400 altogether. Admiral Richards had also said it was not possible to travel over the ice-sea to the North; but that was only the experience of one party, and it had never been attempted elsewhere. He thought it was still quite possible that sledge-journeys might be made to the North under more favourable circumstances. All travellers who had been to the North more than once would state that they seldom found ice in the same situation in successive years, and therefore one season was not sufficient to prove the impracticability of any route. Admiral Richards had said that sledges had not

been introduced for surveying purposes ; but in 1846 he (Dr. Rae), with ten men, surveyed in sledges, under the auspices of the Hudson's Bay Company, at an expenditure of under 1400*l.*, his own pay included, 600 or 700 miles which had baffled three Government expeditions—one under Parry with two ships, one under Captain Lyons with one ship, and one under Sir George Back—and cost the country something like 60,000*l.* or 80,000*l.* The survey, too, was done in such a way that he would not be afraid of even the late Hydrographer to the Admiralty, Admiral Richards himself, going over the ground again. Unfortunately, he broke his chronometers ; but after finding what rate per day he could travel at, he calculated the distances, and, after journeying over 300 miles, he ordered his men to build a snow-house, as he thought he was close to his point of destination, and after another hour's walk he joined his survey with that by Sir James Ross. Admiral Richards also said that if the land reported by the American Expedition had existed, the late Expedition could have got to the Pole ; but surely no one was in such a fool's paradise as to suppose that that channel, Smith Sound, led right away to the Pole. The land laid down on the *Polaris*' chart was only about 70 miles north of  $82^{\circ} 11'$ , which would be upwards of 400 miles from the Pole ; and if the longest journey that could be performed in sledges in a direct line was 350 miles, how could the Pole have been reached, remembering, too, that the longest journey on sledges was where animal life was abundant ? In the excellent Paper which Sir George Nares read at St. James's Hall, he said that the drift on the east coast of Greenland and down Baffin Bay was at the rate of 4 miles a day ; and he instanced the drift of the *Polaris* crew on the ice from the mouth of Smith Sound till they were picked up by the *Tigress*. The distance was stated in the Paper to be 740 miles in 166 days, or nearly 4 miles a day, but the actual distance measured on Petermann's chart was nearly 1600 miles, and the time occupied 201 days, giving an average of about  $7\frac{1}{4}$  miles a day. All the whalers with whom he had conversed stated that the drift in summer was far greater than in the winter. Sufficient allowance had not been made by Sir George Nares for the immense friction and the destruction of the ice caused by the great rivers flowing out of Siberia and the American coast. Those rivers not only wore the ice away, but they opened large spaces of water, and the gales of wind got room to raise a sea, which broke up the ice in a manner which no person could imagine who had not seen it. Sir George Nares also said that the ice formed to a thickness of 7 feet or  $7\frac{1}{4}$  feet : this is true as to the open spaces, but the great floes of which the Expedition met such a quantity were not likely to increase in the same ratio. Ice 40 or 50 feet thick must sink a great deal in the water, and the lower surface must be in warmer water. If the ice was increasing at the rate that Sir George Nares supposed, we should all be in a glacial period very soon. When alluding to the open pool of water which he saw in latitude  $82^{\circ}$  in April, swarming with sea-birds, Lieutenant Payer said nothing about any strong current there, and therefore the conclusion which he (Dr. Rae) drew from that circumstance was quite different from that arrived at by Captain Nares. Wherever there was a channel of water having a very shallow place in it between two deeper parts—one on each side—even with a moderate current, the warmer under-water, in passing over the shallow part, mixed with the surface-water, and it never froze. There were such pools in all the large rivers of America. One which he had seen several times was in the St. Lawrence, close to Lachine. There was an island there, and the whole river was frozen above and below : but in a narrow channel of about 100 yards the water remained open the whole winter, the current not running more than a mile or a mile and a half an hour. The open water was very shallow compared with the parts of the river above and below. One other point he wished to refer to was the kind of sledge that should be used. Sir George Nares had said that the H. B. plan of sledging might do for light loads. He wished

to assure the Society that the contention he had formerly had on this subject did not arise from any personal considerations. He simply wanted the *Alert* and *Discovery* to try his plan with their own. He also thought that snow-shoes would have been useful, and he even sent a pair on board, which proved useful before the winter was over. He had known an Indian woman haul a sledge, with 200 lbs. over and above the weight of the sledge, to the fort at Athabasca, through deep snow, with snow-shoes on.

SIR GEORGE NARES: How many days at a time?

Dr. RAE said they dragged it for weeks together, and he had hauled the same weight himself when wearing snow-shoes. The sledge he proposed could not sink in the snow, and was therefore far better than the runner-sledge. If Captain Beaumont had had flat sledges, he could probably have rounded the point of Greenland seen to the north-east, and Captain Aldrich would have gone 70 or 100 miles further with such sledges, and brought back his men not half so broken-down as they actually were. It had been said that Sir James Ross had tried the flat sledges, but those were a wretched and useless imitation, simply three or four so-called Norwegian snow-shoes tied together. The reason why the Eskimo did not use flat sledges was that they had not tough wood to make them of, and they seldom or never went upon rough ice because they never found walrus or seals there. He could not conclude his remarks without a word of praise for those gallant men who had struggled so valiantly against so many difficulties to attain the object for which they went out.

SIR HENRY RAWLINSON said, although he had had no personal experience in Arctic travelling, he had always taken the very greatest interest in the subject, and had done everything in his power to promote and stimulate Arctic discovery. He had experienced a good deal of discouragement and disappointment from the prospect, which Admiral Richards held out in the early part of his address, of their never being able to make much advance in excess of their present discoveries in the North, but in the latter part of his address he stated some facts which tended to relieve that disappointment. No doubt if any further advance was to be made, it must be in the direction of Spitzbergen; but there were some indications that land assistance might be obtained even there. At the very farthest point reached by Payer he saw land in the extreme distance, trending away towards the Pole, and it was far from improbable—at any rate, the contrary had not been proved—that there might be a range of land stretching away from Franz Josef Land in the direction of the Pole, which might enable sledge travelling to be resorted to. They therefore had two strings to their bow; first, the chance of sea navigation, and next the chance of sledge travelling, and he was therefore very loth to give up the prospect of advancing further North without more examination. He wished also to impress upon the Meeting what he thought had never yet had sufficient importance attached to it, namely, the actual extent and value of Sir George Nares' *bonâ fide* geographical discoveries. Reaching the Pole, supposing it to be ice or sea, would have led to no geographical result whatever, the map would not have been changed one iota; but 25° of longitude in one direction, and between 10° and 15° in another, had now been explored. From the top of Kennedy Channel Captain Aldrich towards the west and Captain Beaumont towards the east had discovered and laid down a long line of coast, but there was still a wide field for discovery in that direction. What must yet be done was the complete delineation of the outline of Greenland, connecting Beaumont's furthest with Parry's furthest on the east side. Until that was done, geographers would not be satisfied. Whether it was accomplished by the Swedes, the Americans, or the English, was really of no great importance, but science required that the whole of Greenland should be, if not circumnavigated, circumsledged. The Geographical Society fully appreciated the results of the

late Expedition, and he was sure the Fellows would be delighted if the Council determined to award their highest honour to Sir George Nares, as he had already been honoured by Her Majesty, the Fountain of Honour.

SIR ALEXANDER MILNE said he held a position at the Admiralty when the late Expedition was fitted out, and indeed when every expedition since 1847 had been despatched, and he was pretty well versed in what had been going on. The object of the Expedition no doubt was, if practicable, to reach the North Pole. From the discoveries of Hall it was supposed that the land beyond the point reached by the *Polaris* trended northward; but Sir George Nares had found it trended to the west on the coast of America, and to the east on the coast of Greenland, and that it was impracticable to pass over the great Frozen Sea, which stretched beyond the point at which the *Aler*t wintered. The sledge-party under Captain Markham could only carry seventy days' provision, thirty-five of which was for the return journey, and must have been sensible that they were on a forlorn hope. It was not expected that when Sir George Nares arrived at his northernmost point he would have to send travelling parties east and west, and so reduce the strength of the Expedition. From all he had read and heard, he believed it was perfectly impossible for the Expedition to have done more than they had done; and when the autumn arrived, what was the use of their again wintering in the ice? They would only go over the same ground; and Sir George Nares exercised a wise discretion in returning to England, and had added largely to the geographical knowledge of the northern part of America and Greenland.

SIR GEORGE NARES, in reply, said the only remarks he felt it necessary to make were in answer to those by Dr. Rae, whom all Arctic travellers looked upon as being about the best critic they could possibly have. Perfectly honest criticism always did good, and from such a successful traveller as Dr. Rae, the more criticisms the better. But it should not be forgotten that even Dr. Rae himself had not done any greater distance in the matter of sledge-journeying than naval parties had done. With regard to the drift, it was only a matter of 2 or 3 miles a day, and what he had said he must stick to. On a former occasion, he mentioned that the rivers of Siberia and other parts did break up the ice in the Polar area, and that the ice first melted away at the mouths of those rivers, so that Dr. Rae and himself were at one with regard to that point. He could not now enter upon the question of the temperature of the water. It was still a moot question what was the temperature inside a glacier. All he had stated was that he had seen ice 100 feet thick, and had noticed water running underneath a glacier long after that water might have been expected to have been frozen. On board of the *Challenger* he used to tell Sir Wyville Thomson, that water under the great glaciers in the Alps could not be below 32°, but he had since found that it could, although he had never met with any explanation of it. He would not enter upon the question of the kind of sledges to be used, but even Dr. Rae, on one occasion came to very rough ice, and had to leave his flat sledges behind, and carry the weights on the backs of his men.

Dr. RAE said the sledges he had on that occasion were not flat but high runner-sledges, such as were used by the late Expedition, which he took good care never to use again.

The PRESIDENT, in conclusion, observed that the discussion had been most interesting and instructive. Although, according to Sir Alexander Milne, the Admiralty contemplated that Sir George Nares could reach the North Pole, the Royal Geographical Society simply desired that the vast Polar area, 1,000,000 or 1,300,000 miles, should be explored as far as possible, and the Expedition had explored a very considerable part of it, doing all that the gallantry and courage of men could accomplish.



*Tenth Meeting, 23rd April, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*A. C. De Crespigny, Esq.*; *John Lobb, Esq.*; *James B. Scott, Esq.*

ELECTIONS.—*Captain Edward S. Adeane, R.N.*; *Ernest Giles, Esq.*; *Henry Goodliffe, Esq.*; *Pringle Hughes, Esq.*; *William Isbister, Esq.*; *Adolphus F. Janvrin, Esq.*; *Archibald Liversidge, Esq.*; *Baron Frederic von Otter*; *C. E. Pitman, Esq.*; *Captain P. A. Scott, R.N.*; *John Joseph Shillinglaw, Esq.*; *George Goldie Taubman, Esq.*; *Captain H. G. Webb (36th Regiment).*

DONATIONS TO THE LIBRARY, MARCH 26TH TO APRIL 23RD, 1877.—*The Cradle of the Blue Nile*, by E. A. de Cosson (*Author*). A short relation of the River Nile, 1791, reprint (*C. R. Markham, Esq.*). *L'Afrique centrale: étude sur ses produits commerciaux*, par R. J. Bernardin (*Author*). Narrative of the discovery of the great central lakes of Africa, by J. L. Clifford Smith (*Author*). *Jøn Jønsonn's Saga*, by G. R. Fitzroy Cole (*Author*). Procès-verbal de la 16me. séance de la Commission Géodesique Suisse, Neuchatel (*Dr. J. M. Ziegler*). A short essay on the Brochs, &c., of the Orkney Islands and North of Scotland, by J. Fergusson (*Author*). Abstract of the Reports of Surveys, &c., in India for 1874-75 (*H.M. Secretary of State for India*). Records of the Geological Survey of India, X., pt. 1 (*The Survey, per W. R. Bion, Esq.*). Annales Hydrographiques, Nos. 559 and 562, and Nos. 558, 560, and 561 of other publications of the French Marine Department (*The Department*). Anuario Hidrografico de la Marina de Chile, iii., 1877 (*J. Vidal Gormaz, Director of the Chilean Hydrographic Office*). The book of Physical Geography, by Keith Johnston (*Author*). Vols. xix.-xxiii. of the Bulletin, xxxv.-xxxviii. of the Mémoires, and xxxiii.-xxxvi. of the Mémoires couronnés, of the Royal Academy of Sciences of Belgium (*The Academy, towards completion of series*). And the current issue of publications of corresponding Societies, &c.

DONATIONS TO MAP-ROOM FROM 26TH MARCH TO 23RD APRIL, 1877.—21 sheets of Admiralty Charts (*Hydrographic Office*). 20 sheets of French Charts (*Dépôt de la Marine*). 102 sheets of the Government Surveys of India, and Map of Baluchistan, &c., 1876 (*H.M. Secretary of State for India, through the India Office*). Hypsometric map of the United States, and Drainage map of Colorado; U.S. Geological and Geographical Survey of the Territories, 1877

(*Dr. F. V. Hayden, Esq.*). 3 maps and illustrations from Petermann's 'Geographische Mittheilungen,' 1877 (*Dr. A. Petermann*).

The following Lecture was then delivered by the Author:—

*On the Temperature of the Deep-Sea Bottom, and the Conditions by which it is determined.* By DR. CARPENTER, M.D., LL.D., F.R.S.

#### INTRODUCTION.

THE distribution of Temperature on the Oceanic Sea-bed is a subject which, when pursued through the whole range of its relations, will be found not inferior in scientific interest and importance to any other department of Terrestrial Physics. A mere indication of the more prominent of these relations will serve to show you their magnitude and extent; and will thus, I hope, enlist your attention to the exposition I have to offer of our present knowledge in regard to it.

In the first place, we are dealing with one of the most important of the Physical conditions of at least *two-thirds of the surface of the solid crust of the Globe*, constituting the bottom of the great Ocean-basins; as to the Thermal state of which it was known more than a century ago, that the surface-temperature of the water which fills those basins, gives us no indication whatever. But although the inquiry has been prosecuted from time to time by Navigators so distinguished as Cook, Phipps, Péron, Krusenstern, Scoresby, Kotzebue, Beechey, John Ross, Parry, Franklin, D'Urville, Du Petit-Thouars, James Ross, Fitzroy, and Belcher, and by Physiologists of such ability as Hales, Saussure, Horner, Sabine, Lenz, Humboldt, Martins, Aimé, Biot, Pouillet, Arago, and Herschel, the imperfection of the methods generally employed has not merely led to a discordance in their results, which long left it in doubt which of them were the most worthy of credit, but has had the yet worse effect of causing statements which we now know to be altogether erroneous, to be widely accepted as scientific generalizations, on account of the high authority on which they were promulgated.

It is not, I think, going too far to say, that the systematic prosecution of this enquiry during the last nine years, beginning with the Cruise of the 'Lightning' in the summer of 1868, continued in the 'Porcupine' Expeditions of 1869 and 1870, and in the 'Shearwater' in 1871, constituting one of the special objects of the 'Challenger' Circumnavigation Expedition of 1872-6, carried into the northern part of the Pacific by the U.S. Frigate 'Tuscarora,' and lastly extended into the North Polar area by our Arctic

Expedition,—has now cleared up most of its obscurities; not only giving to the Physicist, for the first time, a solid basis of fact on which he may securely rest his reasonings, but also unmistakeably indicating the direction in which he is to seek for the *rationale* of the remarkable state of things now presented to his consideration. In following out this clue, he finds himself brought into contact with problems of the most recondite nature in regard to the properties of Water as a Fluid, which are at present occupying the minds of Mathematicians and Engineers of the highest eminence; and I think I shall be able to show you that the evidence afforded by the Thermometer of *vast movements of translation* of Polar water over the whole Oceanic Sea-bed, not only as far as the Equator, but  $50^{\circ}$  beyond it, and attributable to no other agency than the diversities in Specific Gravity occasioned chiefly by diversities in Temperature, is likely to afford data of great value as to the solution of those problems. No more need be said, then, of the interest and importance of this subject in relation to Physics.

The Biological condition of the Deep Sea is so intimately related to the Temperature of the bottom, as obviously to be determined by that condition in a much greater degree than by its depth. This was very strongly impressed on Sir Wyville Thomson and myself in our early investigations. For in the deep trough lying N.E. and S.W. between Shetland and the Faroe Islands, which, as having been our cruising-ground in 1868, I have ventured to call the 'Lightning Channel,' we found at corresponding depths of between 500 and 600 fathoms, and sometimes within a few miles of each other, two Areas whose temperatures differed by more than  $13^{\circ}$  Fahr.; the bottom-temperature of the 'warm area' being about  $43^{\circ}$ , whilst that of the 'cold area' was somewhat below  $30^{\circ}$ . The Faunæ of these two areas showed the most marked diversities. For while the Sea-bed of the 'warm area' was covered with Globigerina-ooze, on the surface of which were multitudes of Siliceous Sponges belonging to the Hexactinellid type, the 'cold area' had a bottom of sand and gravel, and the most conspicuous feature of its Fauna consisted in the number and variety of its Boreal types of Echinodermata. We subsequently found that many species of Mollusca, Crustacea, and Echinodermata supposed to be purely Arctic, range southwards in the cold water of great Atlantic depths, as far south as the entrance of the Mediterranean. And I was thus led in my Report for 1869 to express my entire concurrence in the speculation thrown out some years previously by Professor Lovén, that "there exists in the "great Atlantic depression, perhaps in all the abysses of our globe,

“and continued from Pole to Pole, a Fauna of the same general character, thriving under severe conditions, and approaching the surface where none but such exists,—in the coldest seas.”\* This expectation has been most remarkably confirmed by the ‘Challenger’ researches; one of the most important of the general results of that Expedition being the recognition of an abyssal Fauna essentially the same over the whole Oceanic area that is reached by the glacial underflow, without any relation whatever to the Terrestrial climate of the locality, and scarcely showing any difference according to its Arctic or Antarctic derivation. Thus we see that, even at the present time, the essential conditions of a ‘glacial epoch’ prevail upon the Deep-Sea-bed from each Pole to the Equator; so that the presence of Arctic types of animal life in any *marine* deposit of Temperate or even Tropical zones, affords not the least evidence, *per se*, of the former extension of Glacial action over the *land* of those localities.

By this we see how important is the study of Deep-sea Temperature to the Geologist. For it affords him the means of resolving many difficulties, and avoiding many errors, into which, without such knowledge, he would almost inevitably fall. Thus, as I pointed out in my very first Report,† if the area of the ‘Lightning Channel’ were to be raised into dry land, so that the deposit at present in progress on its bottom should become the subject of examination by some Geologist of the future, he would find one part of this to consist of a Sandstone, including fragments of older rocks, the imbedded Fauna of which would present a distinctly Boreal character; whilst in *stratigraphical continuity* with this he would find a Chalk-like deposit, including an extraordinary abundance of Sponges bearing a strong resemblance to *Ventriculites*, with other animal remains indicative of derivation from a submarine climate probably even warmer than that in which they present themselves. But again, in the middle of our ‘cold area’ we found a bank rising some 300 fathoms from the bottom, so that its surface lay in the comparatively warm upper stratum; and here the characteristically Boreal Fauna was replaced by one of much more Temperate *facies*. Now if this bank were to share in the upheaval just spoken of, the future Geologist would find a hill some 1800 feet high, covered with a sandstone continuous with that

\* ‘Proceedings of the Royal Society,’ Nov. 18, 1869, p. 475.—The similarity of Antarctic to Arctic forms of Marine life had, indeed, been previously noticed by Sir James Ross; and had been attributed by him to the prevalence of a ‘similar temperature’ over the whole intervening Sea-bed. This temperature, however, he erroneously supposed to be 33°·5 Fahr.

† ‘Proceedings of the Royal Society,’ Dec. 17, 1868, p. 193.

of the land from which it rises, but rich in remains of Animals that are not found on the lower plane; and might easily fall into the mistake of supposing that two such different Faunæ, occurring at different levels, must indicate two dissimilar climates separated in Time, instead of depending upon the differences of Temperature that present themselves between two parts of a continuous bottom, according as its elevation or depression causes it to lie in a warmer or a colder stratum of the water of the Channel.

Another very important Geological consideration is the frequent dependence of Bottom-Temperature upon the contour of the solid floor and walls of the basin at great distances; and the consequent liability of the Submarine Climate of any locality to be completely changed by elevations or depressions of parts of the Earth's crust thousands of miles off. Thus, to take a very simple and obvious case, the thermal condition of the whole of the Western basin of the Mediterranean below 100 fathoms would be altogether reversed by such a sinking of the bottom of the Strait of Gibraltar, as would open a communication between the abyssal portions of the Mediterranean and the Atlantic basins. For the place of water of a uniform temperature of  $55^{\circ}$  down to the greatest depths, by which the Western basin of the Mediterranean is now occupied, would then be taken by a succession of layers of Atlantic water becoming progressively colder with depth, bringing down the temperature of the Sea-bed from  $55^{\circ}$  to  $36^{\circ}5$  Fahr. But this would not affect the Eastern basin, unless there were a like sinking of the comparatively shallow sea-bed between Sicily and the African coast, which would give further passage to the flow of glacial water into the abyssal depths that intervene between Malta and the Levant, now occupied by water of  $56^{\circ}$  Fahr.;—the glacial underflow thus extending itself to a distance of more than 2000 miles from its entrance into this great Inland Sea, which is itself removed by 3000 miles more from its Polar source.

If, again, in some former period of the Earth's history, the disposition of Land and Sea was so different from that which now prevails, that either the Polar areas were occupied by land, extending (say) to the 55th parallel, or that both Polar basins were completely enclosed by land, as the Arctic basin now is round three-fourths of its border;—the thermal condition of the Ocean which would then occupy the greater part of the Intertropical zone, would resemble that of the Mediterranean in the absence of any glacial under-stratum; and the comparative warmth of its Sea-bed would enable it to support a Fauna of a very different kind from that which it bears at present.—Hence it is obvious that no

conclusions can be correctly drawn from the distribution of Marine Animal Life in former Geological periods, without a knowledge, not only of the existing distribution of Temperature on the Deep-Sea-bed, but also of the conditions on which each distribution depends; so that the Thermal effects of variations in those conditions may be duly appreciated.

The enquiry on which we are engaged has also a *practical* bearing of such great and increasing importance, that I must not leave it unnoticed in this introductory sketch;—I refer to Submarine Telegraphy. The Temperature of the bottom on which a Telegraph Cable is laid, is an important element in its successful working;—*first*, as modifying the conducting power of the wire; and *second*, by affecting the completeness of the insulation. The conducting power of the wire is so greatly affected by its Thermal condition—being augmented by cold, and diminished by heat—that a wire whose diameter is sufficient to enable it to convey messages across the Atlantic, where it lies on a bottom of about  $36^{\circ}$ , might be quite inadequate to convey the same messages across or along the Mediterranean, where it lies, even at the greatest depths, on a bottom  $20^{\circ}$  warmer. And a wire that should work effectively in the Mediterranean, might be quite ineffective in the Red Sea, on a bottom still warmer by  $15^{\circ}$ . It is obviously essential, therefore, that before constructing a Telegraph-cable for any Marine locality, the Thermal condition of its bottom, no less than its general character, should be carefully determined. This precaution is especially necessary where a cable is to lie along a shallow bottom in the Intertropical Zone, such as that of the Strait of Malacca; for such a bottom is subject to be unusually heated by the ‘downward convection’ I shall hereafter describe. And the neglect of this precaution has been the occasion, as I have learned on the best authority, of very serious losses. The same principle applies to the insulation of the wire, which is much more easily maintained at a low than at an elevated temperature: so that special precautions are required in such cases as that to which I have just referred.

#### TEMPERATURE OF THE DEEP-SEA-BOTTOM.

*Historical Sketch.*—The doctrine current in this country in regard to Deep-Sea Temperatures, at the time when the subject was taken up by Sir Wyville Thomson and myself in 1868, was that which had been expressed by Sir John Herschel not many years previously in the following terms:—“In very deep water all over the globe, a uniform temperature of  $39^{\circ}$  Fahr. is found to prevail; while above

“ the level at which that temperature is first reached, the ocean may  
 “ be considered as divided into three great regions or zones—an  
 “ Equatorial, and two Polar. In the former of these, warmer, in  
 “ the latter, colder, water is found at the surface. The lines of  
 “ demarcation are, of course, the two isotherms of  $39^{\circ}$  mean annual  
 “ temperature.”\* This doctrine seems to have been first promul-  
 gated by D’Urville, as the result of the thermometric observa-  
 tions made by him during the Voyage of the ‘Astrolabe’ (1826-29);  
 which observations, whose correctness had been called in question  
 by Lenz and other Physicists, seemed to be confirmed by those  
 made during Sir James Ross’s Antarctic Expedition (1839-1843).  
 It is clear that in interpreting their observations, both D’Urville  
 and Ross were misled by their belief that Sea-water, like fresh  
 water, attains its greatest density between  $39^{\circ}$  and  $40^{\circ}$  Fahr.:  
 expanding, instead of contracting, as it is further cooled. The  
 latter explicitly says;—“ The experiments which our limited  
 “ time and means admitted of our making, serve to show that the  
 “ mean temperature of the ocean at present is about  $39^{\circ}5$  Fahr.,  
 “ or  $7\frac{1}{2}$  degrees above the freezing-point of pure water, and as  
 “ nearly as possible the point of its greatest density;” and it even  
 seems as if he considered that this point would be most exactly de-  
 termined by exact thermometric observations in Deep Seas, “ as we  
 “ now know where we may send any number of thermometers down  
 “ to the greatest fathomable depths without an alteration of tem-  
 “ perature, even to one-tenth of a degree.”† Yet as far back as  
 1819, Dr. Marcet had ascertained “ that the law of greatest specifi-  
 “ density at  $40^{\circ}$  does not apply to sea-water, but that, on the con-  
 “ trary, sea-water gradually increases in weight down to its freezing-  
 “ point, until it actually congeals.” And he determined the ordinary  
 freezing-point of sea-water to be about  $28^{\circ}$ ; although, when in  
 large vessels, and kept perfectly still, he found that it could be  
 cooled down many degrees below this without freezing.‡

Since the fallacy of the doctrine of D’Urville and Ross has been  
 conclusively demonstrated by the researches of the last nine years,  
 the older observations in which Deep-Sea Temperatures lower  
 than  $39^{\circ}$  were obtained, and of which an admirable collation and  
 discussion has been recently published by Prof. Prestwich,§ have  
 received their merited appreciation. Among the best of these

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\* ‘Physical Geography,’ 1861, p. 45.

† Ross’s ‘Voyage to the Antarctic Regions,’ vol. ii. p. 375.

‡ “On the Specific Gravity and Temperature of Sea-water,” in ‘Philos. Transact.,’ 1819, p. 161.

§ ‘Philosophical Transactions,’ 1875, p. 587.

should be ranked the observations systematically made under the direction of Lenz (by an ingenious but laborious method which he specially devised to avoid the error occasioned by the pressure of waters on the bulbs of Thermometers let down into the Deep Sea) during Kotzebue's Second Voyage (1823-26), and those of Du Petit-Thouars in the Voyage of the 'Venus' (1836-39). And several observations taken by Arctic navigators, which gave bottom-temperatures of 32° Fahr., or even lower, and which were supposed (under the prevalence of the D'Urville and Ross doctrine) to be exceptional, if not erroneous, are now established as both correct and normal.

The explanation of the whole series of discrepancies lies in this,—that while the readings of the Thermometers used by D'Urville and Ross were doubtless correctly taken, the instruments themselves were deranged by the tremendous pressure they encountered when lowered down to great depths in the sea; this pressure being, in round numbers, *one ton on every square inch* for 800 fathoms of depth, or *three tons on the square inch* for what now proves to be rather within than beyond the average depth of the great Oceanic Basins. This pressure, acting on the bulb of the ordinary self-registering Thermometer, produces a compression which forces up a part of its contents into the tube, and thus causes it to register, as the actual *minimum* temperature obtained at great depths, what is really several degrees *above* it. And thus an 'unprotected' Thermometer which shows a temperature between 39° and 40° at (say) 400 fathoms from the surface, still records the same temperature when let down to 750, 1000, 1500, 2000 fathoms, or more, passing through a succession of strata whose real temperature diminishes from 39° to 32°; the progressive reduction in the bulk of the liquid in the bulb, which should have caused the lowering of the index in the tube, being antagonized by the progressively increasing pressure on the bulb, which, diminishing its capacity, forces up its contents into the tube, and thus maintains the index at the same elevation.

The elimination of this source of error,—by the enclosure of the bulb of the Deep-Sea Thermometer in an outer bulb sealed round its neck, the intervening space being partly filled with liquid, but about one-fourth of it being left void, so that the effect of pressure in diminishing the capacity of the outer bulb is not communicated to the inner,—was first devised by Admiral Fitzroy, whose method was worked out twenty years ago by Messrs. Negretti and Zambra; and thermometers thus 'protected' were supplied to Captain Pullen, who made with them an important series of observations



in the Atlantic and the Indian Ocean, which confirmed those of the previous observers who had maintained the existence in those seas of an abyssal temperature as low as  $35^{\circ}$ . His observations, however, were only in part made public, and attracted but little notice,—having obviously been quite unknown to Sir John Herschel; and Admiral Fitzroy's method of 'protection' seems to have been forgotten, save by the Makers who had carried it out. For when the remarkable results which were obtained in the short Cruise of the 'Lightning' in 1868 (p. 290), led me to enquire into the effect of water-pressure on Deep-Sea Thermometers, I could not learn that anything was known as to the amount of error it might introduce, or that any means had been taken to prevent it. A set of experiments was then made by Mr. Casella, at the instance of the Hydrographer to the Admiralty, by which it was demonstrated that a water-pressure of three tons on the square inch caused a rise of from  $7^{\circ}$  to  $10^{\circ}$  in the best Thermometers of the ordinary construction: and in order to prevent this, the late Prof. W. A. Miller devised a method of protection identical in principle with that of Admiral Fitzroy, which was most successfully carried out by Mr. Casella.\* In all the observations since made under the direction of the British Admiralty, as in those of the U.S. Frigate 'Tuscarora,' Six's *maximum* and *minimum* thermometers thus 'protected,' and severely tested by hydrostatic pressure, have been employed with the most satisfactory results; and it may be stated with confidence that by their means, under all ordinary circumstances, the Temperature either of the sea-bottom or of any stratum above it may now be determined with certainty within *half a degree* (Fahr.). When, however, such extreme depths are sounded as the 4475 fathoms once obtained by the 'Challenger,' it is not surprising that a pressure of *five and a half tons* on the square inch should break the bulbs of thermometers which had previously resisted a pressure of more than *four*. And when, as in summer visits to Polar waters, the Temperature of the *surface-stratum* is reduced to  $30^{\circ}$  or under by the melting of floating ice, while its Specific Gravity is at the same time lowered by the reduction of its salinity (so that the water thus chilled does not sink), the temperature of the bottom, or of any intermediate stratum, cannot be satisfactorily determined by the *minimum* thermometer; and recourse must be had to the ingeniously-contrived Thermometer of Messrs. Negretti and Zambra, which records the temperature either of the bottom, or of any stratum to which it may be lowered, by

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\* See 'Proceedings of the Royal Society' for Nov. 18, 1869, p. 409.

a reversal of its position, effected at the moment when an upward movement is given to it by the suspending line.\*

*General Results.*—By the use of these instruments, a vast body of trustworthy information has now been accumulated, in regard not only to the Temperature of the Deep-Sea-bottom, but also to what may be called the Thermal Stratification of the contents of that great Ocean-basin, whose continuity (as Sir John Herschel remarked) is one of the most noteworthy features of the present configuration of our Globe. And it may now be confidently stated as a general fact (1) that over not only the Temperate but also the Intertropical portions of the Oceanic area, a bottom-temperature prevails of between  $32^{\circ}$  and  $35^{\circ}\cdot5$  Fahr.: whilst within the Polar areas this temperature falls to  $28^{\circ}$ . Further, it may be asserted (2) that this vast Oceanic basin, whose average depth may be estimated at about *two miles and a half*, is occupied to within 400 fathoms of its surface (save in the exceptional case of the North Atlantic, p. 310), by water whose temperature is below  $40^{\circ}$  Fahr.,—this cold water actually coming up nearer to the surface in the Equatorial Atlantic (as several of the older observers had noticed) than it does beneath the Tropics.

The case is quite different, however, in regard to the *Mediterranean*; which, although ranking as an Inland Sea, has almost the vastness and depth of an Oceanic basin. For below the superficial stratum of from 100 to 200 fathoms' depth, whose temperature varies with the season, a uniform temperature of from  $54^{\circ}$  to  $56^{\circ}$  (according to the locality) is found to prevail, even down to the abyssal depth of 2000 fathoms;—thus conclusively proving that depth *per se* is not one of the conditions on which depends the Deep-Sea Temperature of  $35^{\circ}\cdot5$ , which prevails in the Atlantic under the same parallels. So in the *Red Sea*, the whole mass of water beneath the variable surface-stratum shows a uniform temperature of  $71^{\circ}$ . And even within the great Oceanic area, there are several minor basins whose Thermal condition presents similar peculiarities. So far, however, from being in any degree anomalous, these exceptional cases will be found to harmonize so completely with the general principle to which we shall find the ordinary phenomena of Ocean Temperature to be referrible, as to afford it the most satisfactory confirmation it could well receive; and I shall make advantageous use of them in the enquiry through which I shall now conduct you, as affording the means of discriminating with certainty between the *local* and the *remote* conditions on

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\* 'Proceedings of the Royal Society' for March 12, 1874, p. 239.

which the Temperature of the Sea-bottom depends. Nothing more is needed, as it seems to me, for the solution of the problem, than what may be called the 'common sense' application\* of those great general principles of Fluid Pressure, with which every tyro in Physical Science is verbally familiar, but of which the bearing seems to me to have been completely misapprehended by some who claim to write with authority on the subject.

#### RELATION OF THE TEMPERATURE OF THE DEEP-SEA TO THAT OF THE SURFACE.

There can be no reasonable doubt that the Temperature of the entire mass of Oceanic water is essentially dependent, either directly or indirectly, upon that of its *surface*; the latter being determined either by Solar radiation, or by the temperature of the superincumbent Atmosphere, or by both combined. For although it might be naturally supposed that the Thermal condition of the solid Crust of the Earth which forms the bottom of the Ocean-basin, would affect that of the Water it contains, yet we know from other sources that any such influence must be rendered nugatory—as compared with that of other agencies—by the very slow conducting power of that crust. The observations which have been made upon thermometers sunk at different depths in the soil of Central Europe, have shown that the *diurnal* variations of its surface-temperature are no longer perceptible at a depth of *three* feet; and that even the extremest *annual* variations are scarcely traceable at a depth of *thirty* feet. And it is well known that corn ripens on the plains of Siberia, with a frozen soil at the depth of a very few feet beneath it. The temperature of the Sea-bed, therefore, will rather be determined by that of the water which overlies it, than will the temperature of the water by that of the bottom on which it rests.† And we have therefore to look at the Temperature of the Earth's crust as a condition whose slowness of operation places it in the class of *secular* agencies; only slightly—if at all perceptibly—modifying the operation of those which obviously exert the greatest potency.

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\* See the letter of Sir John Herschel in the 'Proceedings of the Royal Geographical Society,' vol. xv. p. 211.

† In my first visit to the Mediterranean in 1870, I was struck with the close correspondence between the uniform temperature of the mass of Mediterranean water, and that of the Crust of the Earth in Southern Europe; and was disposed to regard the former as essentially determined by the latter (see my 'Report' for that year in the 'Proceedings of the Royal Society,' Dec. 8, 1870, p. 196). I am now satisfied, however, for the reasons to be hereafter stated, that this correspondence is merely accidental, and that the uniform temperature is essentially determined by *surface*-influences.

We shall in the first place, then, consider generally the relative effects of Heat and Cold applied to the *surface* of large collections of water; as, in the case of *fresh* water, to that of a deep Lake, and, in the case of *salt* water, to that of an Inland Sea. If, in so doing, I should seem to dwell with needless minuteness upon facts with which every well-informed person is familiar, I would ask you to believe that I do so only because convinced by experience of the importance of definitely fixing every point as we go along, and also because the differences in the behaviour of *fresh* and *salt* water under the same Thermal conditions, make it requisite in the study of the latter that the former should be rightly apprehended.

*Action of Surface-Cold and Surface-Heat on a Fresh-water Lake.*—When the surface of a Lake is exposed (as by a change of wind) to an Atmospheric temperature much lower than its own, the superficial film of water loses its heat by radiation; and as this is not restored by conduction from beneath,\* the augmentation of its Specific Gravity produced by the reduction of its bulk causes it to sink until it meets with water as cold as itself, its place being taken by warmer water coming up from below. This fresh film, subjected to the same surface-cold, sinks in its turn; and so long as there is water beneath that is warmer than the water of the surface, this *downward convection of Cold* continues, until the temperature of the entire mass, down to its very bottom, has been reduced to  $39^{\circ}2$  Fahr., the temperature at which fresh water is reduced to its smallest bulk and possesses its greatest Specific Gravity. But as any further reduction in the temperature of the superficial film causes it to expand, instead of contracting, it is thus rendered specifically lighter, instead of heavier, than the subjacent water; and being thus kept at the surface, it is further cooled until it freezes, while the stoppage of the downward convection leaves the whole mass beneath at the temperature of  $39^{\circ}2$ .

When, on the other hand, the surface-water of a Lake is subjected either to direct Solar radiation, or to the contact of an atmosphere warmer than itself, the film whose temperature is thus raised will expand; and thus, becoming specifically lighter, will tend to remain *at* the surface, *no downward convection of Heat* (at temperatures above  $39^{\circ}2$ ) being possible in fresh water.—The limit to the downward action of Surface-Heat, therefore, in the case of *fresh* water, will be that of the direct penetration of the Solar rays; below which the water that has been once cooled-down can only be warmed again by *conduction* either from above or from

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\* The conducting power of Water is so small that we may practically disregard it, except in questions of 'secular' adjustment of Thermal Equilibrium.

below,—a process so slow that it has no perceptible effect in modifying *seasonal* variation. And hence the Heat that acts on the surface of *fresh* water is mainly expended (so to speak) in producing evaporation, and is thus dispersed whithersoever that vapour may be transported; while the Cold similarly applied may be said to pass into the water itself, on which it consequently exerts a *cooling* effect that is far greater than the *warming* effect produced by an equivalent amount of Surface-Heat. That cooling effect, however, is limited, as regards deep water, to  $39^{\circ}2$  Fahr.

*Thermal Condition of the Swiss Lakes.*—We have an admirable exemplification of this principle, in the Thermal condition of the deep Lakes of Switzerland; which has been recently determined by a careful series of observations made in connection with the study of their Biological conditions.\* The entire basin of each lake may be considered as lying under the same range of Atmospheric temperature, and as subjected to the same Solar radiation. The temperature of the surface varies, of course, with the diurnal and seasonal variations of atmospheric temperature; but the effect of the former soon becomes imperceptible as it is traced downwards; and that of the latter entirely ceases at a depth of between 25 and 30 *mètres*,—or, in round numbers, between 80 and 100 feet. Below that depth, and down to the very bottom of each Lake,† a *uniform* and *constant* Temperature is met with, the variation not amounting to  $0^{\circ}1$  Cent.; so that, as Dr. Forel remarks, “les grands profondeurs” “des lacs d’eau douce sont probablement le milieu le plus invariable” “au point de vue de la température où les animaux soient appelés” “à vivre sur notre terre.” This constant temperature differs in different Lakes, being  $5^{\circ}$ ,  $6^{\circ}$ ,  $7^{\circ}$ , or  $8^{\circ}$  Cent. ( $=41^{\circ}$ ,  $42^{\circ}8$ ,  $44^{\circ}6$ ,  $46^{\circ}4$ , Fahr.), according to their locality. It is clear, therefore, that as neither diurnal nor seasonal variations show themselves beneath a stratum of 100 feet in thickness, this must be the extreme limit of the direct heating power of the Sun. And thus, to whatever point the downward convection of Cold during the winter reduces the temperature of the whole of the deeper stratum of any such Lake, that temperature will be retained by it with scarcely any variation from one year to another. Whether this constant temperature represents the mean winter Air-temperature of the locality, must

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\* “Faune profonde du Lac Léman,” in *Acta Soc. Helv. des Sci. Nat.* Schaffhausen, 1873.

† The Lake of Constance has a maximum depth of 964 feet, and the Lake of Geneva of about 1000; the bottoms of both being above the level of the sea. On the other hand, the greatest depth of the Lake of Como is 1981 feet, of which two-thirds lie beneath the sea-level; and the greatest depth of the Lago Maggiore is 2800 feet, of which more than three-fourths lie beneath the sea-level.

be determined by further observation. It has been found to do so very closely in the case of Loch Lomond; the bottom-temperature of which, and the mean winter air-temperature of the locality, are both  $41^{\circ}$ . But there are several conceivable conditions which may prevent this accordance from being precise; such, for example, as relative differences in the effect of Solar radiation on the Atmosphere and on Water, and the modifications produced in the former by Hygrometric conditions.

*Action of Surface-Cold and Surface-Heat on an Inland Sea.*—The action of Cold applied to the surface of a body of salt water, is affected in a very important way by a property which notably distinguishes it from *fresh* water,—that of contracting, and therefore increasing in Specific Gravity, *down to its freezing-point*; so that whilst fresh water is no heavier when just about to freeze than it is at about  $46^{\circ}$ , sea-water is at its heaviest when just about to freeze; and whilst its solidification ordinarily takes place at  $23^{\circ}$  Fahr., it may be cooled down, by being kept very still, as low as  $25^{\circ}$  (or even, according to Dr. Marcet, as low as  $22^{\circ}$  Fahr.) with a still further increase of density. Hence it is an invariable rule for Sea-water (its salinity being taken as constant), that *the colder it is, the heavier it is*. And from this it will obviously result that, supposing the water of an Inland Sea to be subjected to Atmospheric Cold, its surface-cooled films will continue to sink, one after another, and to be replaced by warmer water coming up from below, until the whole mass of its water shall have been brought down to near  $28^{\circ}$  Fahr.;—no ice being formed on its surface until that reduction shall have been completed. And thus severe Cold continuously applied to the surface of a body of Salt water, passes down to its greatest depths, reducing the temperature of the entire mass more than  $10^{\circ}$  (Fahr.) below what is possible in a deep basin of Fresh water.

The effect of Heat also, applied to the surface of Sea-water, is modified by its Salinity. For the increased evaporation which takes place from the superficial film, by concentrating its salt, renders that film specifically heavier than the subjacent water, notwithstanding its higher temperature; and it consequently descends through the less saline but colder subjacent water, which rises up to replace it. Thus a *downward convection of Heat*, though impossible in *fresh* water, is a necessary consequence of the action, either of Solar radiation, or of hot dry Winds (which still more strongly promote evaporation), on the surface of *salt* water; and we shall presently see that this is an agency of great importance.

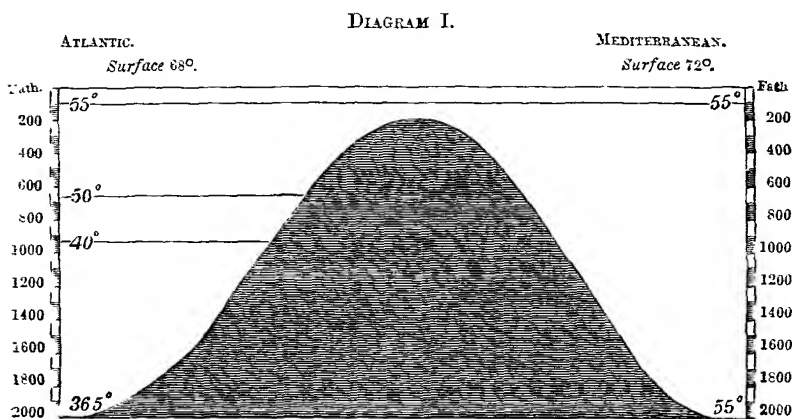
*Thermal Condition of the Mediterranean.*—There is no Inland Sea whose Thermal condition has been so carefully studied as that of the Mediterranean; and we shall find the study of it peculiarly instructive. Its bottom-temperature was first examined by Saussure in 1780 by two soundings taken in the Gulf of Genoa, one at 158 and another at 320 fathoms; and notwithstanding the imperfection of his method, the results he procured,— $55^{\circ} \cdot 5$  Fahr. at both depths,—closely accord with those subsequently obtained with trustworthy instruments. In 1826, D'Urville, when starting on the circumnavigation voyage of the 'Astrolabe,' determined by serial soundings between Toulon and Gibraltar, that the Temperature of the Mediterranean decreases from the surface downwards to about 180 fathoms, below which he found it constant at between  $54^{\circ}$  and  $55^{\circ}$  Fahr. to a depth of more than 500 fathoms; and the same temperature was found by Bérard in 1831 to extend to a depth of more than 1000 fathoms. These results were confirmed by those obtained in 1840–44 by Aimé; who carried on a series of observations through several seasons between Marseilles and Algiers; not extending them, however, to any great depths. He found that the *diurnal* variations of temperature are confined to a thin superficial stratum of less than 10 fathoms; and that the *seasonal* variations cannot be traced below 200 fathoms; beneath which depth the temperature is *uniform* and *constant*. No observations seem to have been taken before 1871 in the Eastern basin of the Mediterranean, save those of Admiral Spratt; who confirmed Aimé's conclusions as to the constant and uniform temperature prevailing at all depths below 300 fathoms, but was led by the error of his Thermometers to estimate that constant Temperature at about  $59^{\circ}$ , which is  $2^{\circ} \cdot 5$  too high. In the summer of 1870, I made a series of careful Temperature-soundings with 'protected' Thermometers in the Western basin of the Mediterranean, at several points between Gibraltar and Malta; and in the summer of 1871, I extended these observations into the Eastern basin between Malta and Alexandria. By combining my own results\* with those of Aimé, I shall be able, I think, to give you a very exact account of the Temperature phenomena of this vast basin, almost Oceanic in its extent and depth.

The marked contrast shown by D'Urville's Temperature-soundings, between the Thermal condition of the Mediterranean and that of the Atlantic under the same parallels, was rightly attributed by Arago to what we now know to be indubitably its true

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\* These results are given in detail in my Reports to the Royal Society; 'Proceedings' for 1870, p. 193. and 1872, p. 578.

cause,—the seclusion of the Mediterranean basin from that underflow of Polar water by which the temperature of the abyssal depths of the Atlantic is kept down. For the Strait of Gibraltar, which has a depth of about 500 fathoms between Gibraltar and Ceuta, gradually shallows as it widens towards its western *embouchure* between Capes Trafalgar and Spartel; where there is a ridge or 'submarine watershed,' of which the general depth is about 120 fathoms, only certain passages across it approaching 200 fathoms in depth. This ridge, as shown in Diagram I., inter-



poses an effectual barrier to the entrance of all Atlantic water *below* about 54° Fahr.; while it admits a large influx of its upper stratum *above* that temperature, drawn in by the excess of evaporation from the general surface of the Mediterranean over the whole amount returned to its basin by rain and rivers. Now, although the water brought in by this 'Gibraltar Current' is a few degrees cooler than that with which it meets in the basin it enters, I think it clear that this inflow can have very little influence upon the general temperature of the vast mass of water which occupies the Mediterranean basin. For the inferior salinity of the Atlantic water thus drawn in, keeps it at the surface (as I have ascertained by Specific Gravity observations) notwithstanding its lower temperature; and it cannot sink until it has been sufficiently concentrated by evaporation to attain the salinity of the ordinary Mediterranean water, in the course of which process it must acquire from above the Heat which is required to bring it up to the general Mediterranean standard. And, as a matter of fact, I found myself quite unable to trace the cooling influence of the Gibraltar current further east than a line joining Cartagena and Oran. Hence, as the entry



of the deeper and far colder strata of Atlantic water is effectually barred by the shallowness of the ridge that forms what may be called the 'marine watershed' between the two Seas, we may discuss the thermal peculiarities of the Mediterranean as if its basin were completely closed.

The extension of the Mediterranean basin in the East and West direction, brings its whole area under Climatic conditions almost as nearly identical, one part with another, as those of any of the larger Swiss lakes. For the parallel of  $36^{\circ}$  N. Lat.,—which passes from the Strait of Gibraltar to the mouth of the Orontes, between the two Maltese islands, between Crete and the Morea, and between Cyprus and Asia Minor, through  $42^{\circ}$  of Longitude,—has nearly the whole of the Western basin lying within  $7^{\circ}$  Lat. to the north of it, while nearly the whole of the Eastern basin lies within  $4^{\circ}$  Lat. to the south of it. The Climatic uniformity hence resulting is strikingly shown in the course alike of the Summer and of the Winter Isotherms. For the southern boundary of the Mediterranean nearly coincides with the Summer isotherm of  $80^{\circ}$ , which closely follows its African coast-line; and since even its most northerly portions (the Gulfs of Lyons and Genoa, and the head of the Adriatic) lie very little beyond the summer isotherm of  $75^{\circ}$ , we may consider its general surface as subject to a mean Summer air-temperature ranging between  $75^{\circ}$  and  $80^{\circ}$ . So we may consider the mean Winter air-temperature over the Mediterranean area as ranging between  $50^{\circ}$  and  $55^{\circ}$ ; only the northernmost extensions of that area lying beyond the Winter isotherm of  $50^{\circ}$ .

Now the Surface-temperature of this Sea at different seasons follows very closely the Air-temperature; being usually somewhat lower in summer (especially when the dryness of the atmosphere favours evaporation), and somewhat higher in winter. But while its Winter-temperature is uniform, or nearly so, from the surface to the bottom—even at 2000 fathoms' depth, the high Summer-temperature of the surface shows a rapid reduction in the subjacent strata; coming down in the Western basin from  $70^{\circ}$ ,  $75^{\circ}$ , or even  $80^{\circ}$ , to about  $58^{\circ}$  Fahr., at a depth of 50 fathoms, and to  $55^{\circ}$  at 100 fathoms, at which point it ceases to descend further; and in the Eastern basin to  $64^{\circ}$  at 50 fathoms,  $59^{\circ}$  at 100 fathoms,  $57\frac{1}{2}^{\circ}$  at 200 fathoms, and  $56\frac{1}{2}^{\circ}$  at 300 fathoms, below which point it ceases to descend further. Thus we have in the Western basin an enormous stratum of water having a thickness ranging to 1400 fathoms (8400 feet), and in the Eastern basin a stratum of 1700 fathoms (10,200 feet), whose temperature is alike *uniform* from above downwards, and *constant* through all seasonal changes;

and the coincidence of this uniform temperature with the ordinary Winter-temperature of the upper variable stratum, leaves no room for doubt that it represents the *mean winter-temperature* of the Mediterranean area,—the slight difference between the constant Temperatures of the two basins corresponding with the slight difference in their Latitudes.

It is obvious on a little consideration that such would theoretically be the case. Suppose the mean winter-temperature to be *lower* than it is, the cooling of the surface-water would produce a downward convection-movement, which would reduce the temperature of the deep stratum; and this, being below the range of solar radiation, or even of the downward convection of heat from the surface, would not have its temperature raised again, when the return of summer warms the superficial layer. If, on the other hand, the mean winter-temperature were to be *higher* than it is, even the deepest stratum, having nothing to keep down its temperature, would *in time* become warmed by conduction up to the winter standard of the superficial layer.

The influence of Salinity upon the thickness of that sub-surface stratum which is affected by Heat acting on the surface, is well shown by comparing the Thermal condition of the Mediterranean basin with that of the Swiss Lakes. For whilst the temperature of the deeper portion of the former is as uniform as that of the deeper portion of the latter, there is a marked excess in the depth to which seasonal variations extend from the surface downwards. Instead of being limited to 100 feet—the extreme depth to which the influence of solar radiation can be traced in the Swiss lakes,—the effect of the heat applied to the surface of the Mediterranean shows itself very perceptibly in the Western basin at 50 fathoms (300 feet), and in a slighter degree at 100 fathoms, and in the Eastern even to more than 200 fathoms; the excess in the latter being accounted for by the greater power of the solar rays, and by the greater heat and dryness of the winds to which its surface is subjected, producing a greater evaporation and concentration. And we thus plainly see how very much more potent is the *downward Convection of Heat*, in the case of Salt water, than direct *Solar Radiation*, whose power of penetration can scarcely be greater in salt water than in fresh.

The uniformity of Temperature in all but the superficial stratum of this vast basin, seems to have a very important influence on the Biological condition of its bottom: since the absence of any change in the Thermal equilibrium of its deeper stratum, will leave its Static equilibrium entirely undisturbed; so that the

whole of that mass of water in the Mediterranean basin, which is removed by its depth from the action of winds and tides on its surface, must be in an absolutely stagnant condition, which, as I have shown on a former occasion,\* renders it incapable of supporting Animal life (in any quantity at least) at great depths, except near its western *embouchure*.

*Thermal Condition of the Red Sea.*—The Red Sea presents us with another case in which the Bottom-Temperature seems exclusively dependent on local conditions. For the greater part of the Strait of Babelmandeb is so extremely shallow, that none but the warm surface-water of the Arabian Gulf can enter through it; and the quantity of the cooler water of the sub-surface stratum which can find its way inwards through the deeper passages of the Strait, must be quite insignificant in comparison with the great mass contained in a basin more than 1000 miles long, whose depth ranges to between 600 and 700 fathoms. Now, as this indraught, like the Gibraltar current, is entirely due to the excess of evaporation over precipitation in the Red Sea area, and as the water which thus enters the basin is of lower salinity than that which it finds there, it must float on the surface, until its Temperature has been raised by insolation, so that its Specific Gravity is augmented by evaporation. And it seems to me, therefore, beyond question that its influence on the Temperature of the subjacent mass must be trivial, in comparison with that of the powerful insolation and heated atmosphere to which the surface-water of the Red Sea is exposed during a large part of the year.

That there is not over the Red Sea area by any means the same uniformity of Climatic condition as that which prevails in the Mediterranean, might be anticipated from the direction of its long axis, which lies about N.N.W. and S.S.E., and ranges through about 15° of Latitude. But the range of Temperature, whether local or seasonal, is much less than the difference of latitude between its two extremes would lead us to anticipate. For the whole of its area lies between the two Summer Isotherms of 90°, of which one crosses its northern and the other its southern extremity; while its middle portion lies between the two Isotherms of 95°. Its northern extremity lies just outside the Winter Isotherm of 60°, while it is crossed by the Winter Isotherm of 70° a little to the south of Mecca, and by that of 75° near its southern extremity. The mean Winter air-temperature of the whole area may thus be

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\* See "Further Enquiries on Oceanic Circulation," in 'Proceedings of Royal Geographical Society,' 1874, Par. 41.

somewhat below  $70^{\circ}$ . Now the monthly means of the surface-temperature of the water differ singularly little;—ranging only from  $78^{\circ}$ – $7$  in January to  $88^{\circ}$  in September. And although the extreme range is rendered very considerable by the occasional extraordinary superheating of the surface-water—the thermometer having been seen to stand at  $100^{\circ}$ ,  $106^{\circ}$ ,  $100^{\circ}$ , and  $96^{\circ}$  on four consecutive days, while the air-temperatures on the same days were  $80^{\circ}$ ,  $82^{\circ}$ ,  $83^{\circ}$ , and  $82^{\circ}$ —it is quite exceptional for the surface-temperature to fall many degrees below the  $70^{\circ}$  which may be regarded as the average Isocheimal of the entire basin. Now this, so far as we at present know, corresponds with the *constant* and *uniform* Temperature of all but the variable upper stratum of Red Sea water: the thickness of which seems to be much the same as in the Eastern basin of the Mediterranean. For Capt. Pullen found that with a surface-temperature rising even to  $86^{\circ}$ , and a temperature at 50 fathoms of  $77^{\circ}$ , the thermometer sank to  $71^{\circ}$  at a depth of 200 fathoms, and then continued stationary to the bottom at 678 fathoms. And Sir George Nares found the water of the Gulf of Suez in February to be  $71^{\circ}$  from the surface to the bottom at 450 fathoms; its superheated stratum being brought down to that standard by the cooling influence of the atmosphere above, but being prevented from showing a more than slight and temporary reduction beneath it, by the existence of the great mass of water of that temperature beneath. For whenever a surface-film may have been so far cooled by a low air-temperature as to sink, its place will be taken by the ascent of water of  $71^{\circ}$  from beneath. A *continuous* interchange of this kind would of course lower the temperature of the whole subjacent water; but it is probable that it is not sufficiently prolonged to affect more than the variable stratum, the temperature of which will be quickly raised by the downward convection of Heat, so soon as the sun begins to approach the Equator.

It seems clear from these two instances, that the seclusion of the deeper part of a Marine basin from the influence, whether direct or indirect, of the Solar Rays upon its surface, has no other effect upon the Thermal condition of its contained water (and consequently of its Bottom-Temperature), than that of preventing that temperature from being raised, during the warmer part of the year, above that which belongs to the upper stratum during its colder part; thus leaving it constant through the whole range of seasonal variation. And this conclusion is in entire accordance with the strongly contrasted results of similar observations in Seas whose surfaces are subjected to extreme winter Cold, whilst the deeper parts of their

basins are secluded from the influence of warmer water outside ; as is the case with the Sea of Okhotsk.

*Thermal Condition of the Sea of Okhotsk.*—This is a basin of no great depth, lying between the same parallels of Latitude as the British Isles, and shut in by the peninsula of Kamtchatka, the large islands of Sagalian and Yesso, and the chain of the Kuile islands, between all which the Straits are shallow. Dr. Horner, who accompanied Krusenstern's Expedition in 1803, found that with a surface-temperature in August of  $46^{\circ}4$ , the thermometer sank in this Sea at only 18 fathoms to  $31^{\circ}6$ , and at 60 fathoms to  $29^{\circ}$ , which temperature continued constant to the bottom at 115 fathoms. Thus it is obvious that the deeper water permanently retains the influence of the low Winter air-temperature of that region, which lies between the January Isotherms of  $+ 20^{\circ}$  and  $- 20^{\circ}$  Fahr.; only the superficial stratum of about 50 fathoms' thickness having its temperature raised by the warmth of the Summer, although it is crossed by the July isotherm of  $60^{\circ}$ .

*Thermal Condition of the Arctic Basin.*—The Temperatures taken at various depths within the North Polar area by Scoresby, Parry, Ross, Martins and Bravais, and more recently by Payer and Weyprecht, Leigh Smith, and other observers, may be regarded as indicating that beneath a variable surface-stratum, the temperature and thickness of which depend partly on the season, and partly on the extension into that area of the warm upper-flow commonly designated the Gulf-Stream, there lies a great depth of proper Polar water, the temperature of which is from  $30^{\circ}$  to  $28^{\circ}$  Fahr. Still lower temperatures, it is true, have been occasionally noted; two of  $27^{\circ}$  by Mr. Leigh Smith in 1873; one of  $25^{\circ}75$  by Sir Edward Sabine in Ross's Expedition, 1818; and one of  $22^{\circ}5$ , and another of  $22^{\circ}3$ , by Mr. Leigh Smith in 1873. With regard to the last three of these I must own myself sceptical; thinking it more probable that the instruments which recorded them were faulty, than that water should have remained at the surface without either freezing or sinking, until cooled down to  $25^{\circ}75$ , or even to  $22^{\circ}3$ ; and should have carried those extremely low temperatures down to the bottom, still remaining liquid. And I place more confidence in the recent observations of Sir George Nares; who found that when Temperature soundings were taken through holes bored in the 'palæocrystic' ice, the thermometer at all depths, from just beneath the ice to the bottom, showed a temperature of  $28^{\circ}$ . This, as I have already shown, is exactly what theory would lead us to anticipate;  $28^{\circ}$  Fahr. being the lowest temperature to which surface-Cold can bring down Sea-water without causing it to freeze, unless the water be

kept quite motionless; and the freezing of the surface-stratum being only possible when the whole subjacent mass has been cooled to  $28^{\circ}$ . And as this temperature, in the absence of any agency that can exert more than a slight and temporary effect, will be permanently maintained, we seem justified in regarding  $28^{\circ}$  as the constant and uniform temperature of all but the superficial stratum of the contents of a Polar basin subject only to local conditions.

*Local Effects of Vertical Convection-Movements.*—Thus, then, the Bottom-Temperature of any deep basin of Sea-water subjected to local influences alone, will be essentially determined by *vertical convection-movements*. Such movements *must* be generated, as every Physicist knows, by any cause that so disturbs the Equilibrium of the mass, as to make its upper stratum specifically heavier than its lower. In the case of *fresh* water, such disturbance can only be produced by difference of Temperature; and this will be just as effective, and will operate in precisely the same manner, whether we apply *Heat to the bottom* or *Cold to the surface*. In fact, what I have spoken of as the *downward convection of Cold*, might just as properly be described as the *upward convection of Heat*; being an interchange of position between the warmer stratum below and the colder stratum above. And this may be demonstrated in a laboratory-experiment, as well by applying a piece of ice to the surface of water in a tall jar, as by applying a lamp to the bottom of a flask. For as, in the latter case, the water ascends in the heated middle of the flask, and descends at the sides kept cool by the atmosphere—as can be readily shown by the course of particles of charcoal diffused through it,—so, in the former, the water descends in the chilled middle of the jar, and ascends at the sides kept warm by the atmosphere around.

That such convection-movements may be produced and sustained by very small disturbances in Fluid Equilibrium, occasioned by differences of Temperature, there is ample evidence. The following is a remarkable example, which fell within my own knowledge in early life, and made a strong impression upon me. Mr. West, a very ingenious mechanician at Bristol, having heard of the success of Mr. Peter Barlow's plan (1828–1832) of constructing Object-glasses for Telescopes of moderate aperture, in which the double concave of flint-glass was replaced by a highly refracting fluid (such as sulphuret of carbon, or oil of cassia), carried out this plan on a large scale in the construction of an Object-glass of eighteen inches in diameter. By the mathematical aid of Mr. Barlow, and his own great mechanical ability, this object-glass (exceeding in diameter that of any Refracting Telescope which had been at that time

constructed, was completed with theoretical correctness; but when it was brought into use, its performance was found to be so seriously impaired by movements produced in the fluid, by the very slight disturbances in the equality of the Temperature of its different parts occasioned by atmospheric currents, that in spite of every precaution which could be taken for its protection, it was found to be valueless for the purpose of Astronomical research.—Those, again, who have been accustomed to the minute observation of Aquaria, have frequently noticed currents, marked by the movement of minute suspended particles, that could only be attributed to slight differences of Temperature; and Prof. Möbius of Kiel,\* who has given much attention to this inquiry, has ascertained that a difference of *half a degree* of Reaumur is quite sufficient to produce *sensible movement*.—Further, Mr. Rainey, who had paid great attention to the internal motions of small collections of liquid entirely enclosed within glass and placed under the Microscope, published some years since a series of observations, which show that definite currents, made obvious by the translation of suspended particles, take place in liquids thus enclosed, under conditions that seem to exclude any other agencies than inappreciable differences of Temperature.†

As there can be no reasonable doubt that similar vertical convection-movements must take place in any mass of *salt* water whose Fluid Equilibrium is disturbed by an increase in the Salinity (and consequently in the Specific Gravity) of its upper stratum, we see how such disturbance becomes the chief means of *conveying Heat downwards*. And when we duly appreciate this principle, we shall find that it can be largely applied to the explanation of many of the phenomena of Ocean-Temperature. Thus the greater depth to which the effect of surface-heat is traceable in the Intertropical portions of our great Oceans, than it is in the Mediterranean, is exactly what might be expected, when it is borne in mind that while in the latter case the heat is seasonal only, it is constant in the former, the surface of the sea being subjected through the whole year to the rays of a nearly vertical sun. And it seems probable (as Mr. Buchanan has shown‡) that it is in virtue of the greater Salinity of the water of the Gulf-Stream, produced by the excess of evaporation from its surface, that the accumulation of that water in the middle portion of the North-Atlantic carries down a temperature of above 60° to a depth nowhere else met

\* See 'Annals of Natural History,' Series 4, vol. viii. p. 201.

† 'St. Thomas's Hospital Reports,' New Series, vols. i. and ii.

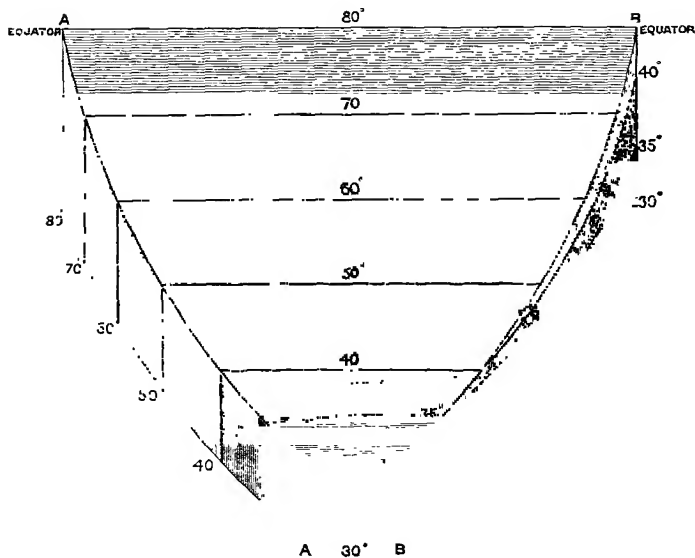
‡ 'Proceedings of the Royal Society,' vol. xxiv. p. 597.

with, and thus makes this portion of the basin a storehouse of warmth for the north-western and northern shores of Europe.

Where these two agencies are acting together,—the Specific Gravity of one stratum being augmented by Cold, whilst that of another is augmented by increase of Salinity,—the problem becomes a complicated one; the state of disturbance of Fluid Equilibrium, and the consequent upward or downward direction of the Convection-movement tending to restore it, being only determinable by an exact computation based on the relative Temperatures and Specific Gravities of the different strata. A large mass of material for such computation has been collected in the 'Challenger' Expedition; and it is much to be desired that it should be worked up by some Physicist competent to the task. I confine myself at present to those great general phenomena, in regard to the conditions of which, as it seems to me, there can be no reasonable question.

If, taking as our basis the Thermal condition of the Mediterranean and Red Sea, we were to frame a Temperature-section of

DIAGRAM II.



(say) the South Atlantic basin, from the Equator to the Antarctic ice-barrier, taking account only of the *local* or *surface*-influences which affect the temperature of each zone, we should have to represent the thermal condition of that vast mass of its contained



water which lies between the upper variable stratum and the bottom, by a set of Isotherms passing *vertically downwards* (see Diagram II., A, A), and ranging from nearly  $80^{\circ}$  at the Equator to  $28^{\circ}$  beneath the Antarctic ice. For there would be nothing to depress the bottom-temperature of even the abyssal depths that underlie the Equator, beneath the lowest mean of the surface-stratum; while, on the other hand, the temperature of nearly the entire column of Polar water would be kept down by the extreme cold of winter, to the lowest temperature at which sea-water can remain unfrozen. And since the constant temperature of the uniform stratum in each Latitude would correspond with the Isocheimal of that latitude, the succession of these vertical isotherms between these two extremes would be the same as that of the July (or winter) isotherms of the surface.

But what do we find to be the actual fact?—The Isotherms, instead of lying *vertically*, lie in almost *horizontal* parallelism, with merely an upward slope towards the Pole (see Diagram II., B, B.); so that a tolerably regular Thermal Stratification presents itself, from the bottom at 2000 fathoms or more, on some parts of which the temperature is as low as  $32^{\circ}4$ , and scarcely anywhere more than a degree above this, to  $35^{\circ}$  at an average depth of about 1600 fathoms, and so upwards to  $40^{\circ}$  at an average of about 300 fathoms, above which the temperature rises to that of the surface with a rapidity proportionate to the approximation of the locality to the Equator. Now this is equivalent to saying that the temperature of this basin from 300 fathoms to the bottom has been *imported* from the Antarctic area; the coldest and deepest stratum beneath the Equator having flowed direct thither, probably without any considerable admixture with other water, from a zone sufficiently near the Pole for its entire mass to be under  $32^{\circ}$ ; while the successive strata of below  $40^{\circ}$ , that overlie this to a thickness of 1800 fathoms or more, must consist, in great part at least, of water that has come from a zone lying between the isocheimals of  $32^{\circ}$  and  $40^{\circ}$ . What agency, then, has brought water all the way from the Antarctic area into the Equatorial portion of the South Atlantic basin, in such enormous mass as nearly to fill it?

*Horizontal Convection-Movements.*—To answer this question satisfactorily, we must consider what will happen when Cold is applied continuously (as by a cake of ice renewed from time to time, or by a metal box filled with a freezing-mixture) to a *limited part* only of the surface-water of a basin. The very same downward convection-movement, which progressively lowers the temperature of the entire mass of water when cold is applied to its *whole* surface, here goes

on beneath the locally-cooled surface; but the place of the water which descends will be taken, not by water rising up from below, but by water drawn in from the surrounding area; whilst, on the other hand, the films of chilled water as they successively fall to the bottom, will not pile-up one on another, but will spread themselves over the bottom of the basin, thus lowering the temperature of its whole area by a *horizontal* convection-movement. This horizontal movement is a necessary consequence of the augmented Specific Gravity of the chilled films, which, according to the law of fluid pressure, will have an excess of *lateral* pressure equal to their excess of weight or *downward* pressure, and will thus take the place of the warmer and lighter water around, raising it towards the surface to take the place of that which has been drawn into the chilled area. In this manner the successive thinned-out films of chilled water will progressively pile themselves up over the *entire bottom* of the basin; and as one part of the surface-stratum after another is subjected to this influence, a larger and larger proportion of the whole contents of the basin suffers a reduction of temperature; until, by a persistent application of cold to the same spot, the entire mass will be as effectually cooled down, as if the cold had been applied to its entire surface,—more slowly, however, on account of the exposure of the unchilled portion of the surface to a higher air-temperature. But even a considerable elevation in the temperature of the surface-layer by the direct application of heat to some other part of it, will only *retard* the cooling of the mass beneath; requiring an increased expenditure of Cold (so to speak) for the reduction of the temperature of the warmed water that is drawn into the chilled area.

Now this will be as true of a large basin as of a small one. Supposing the whole of the South Atlantic to be filled with water of the temperature (say) of  $60^{\circ}$ , and the part of it within the Antarctic Circle to be covered with ice at or below the temperature of  $28^{\circ}$ ,—it is obvious that the continued refrigerating effect of this ice will be progressively to lower the temperature of the entire mass of South Atlantic water, except that of the stratum whose temperature is kept up either by the direct application of surface-heat—as in the Equatorial and Temperate Zones,—or by the horizontal convection of heat from those zones by surface-movement.

This plain and obvious deduction from the fundamental principles of Physics has been designated as the “Gravitation Hypothesis”; as if there could be any doubt of the fact that the coldest—because the heaviest—Sea-water *must* find its way to the bottom (unless its salinity has been reduced by dilution with fresh), as certainly as a

stone falls to the ground. Any one who denies this, must be prepared either to disprove the accepted laws of Fluid Pressure, or to prove that Water is not a fluid.

*Thermal Condition of the Pacific.*—Let us now test this conclusion by applying it to the far vaster basin of the Pacific, which ranges from the Antarctic to the Aleutian islands, over (speaking roughly) one-third of the circumference of the globe. Now if the temperature of each part of this enormous area were determined, like that of the Mediterranean, by local influences alone, we should find it to correspond in each parallel of Latitude with the surface-Isocheimal, or mean Winter-temperature, of that latitude; thus ranging from between  $70^{\circ}$  and  $80^{\circ}$  in the Intertropical zone, to  $60^{\circ}$ ,  $50^{\circ}$ , and  $40^{\circ}$ , in the successive parallels of the North and South Temperate zones, and only descending towards  $35^{\circ}$  as the northern and southern parallels of  $60^{\circ}$  are approached.

But what do we find to be actually the case? Wherever the Sea-bed of this vast area lies at a greater depth than 1500 fathoms, it is covered by a stratum of water having a temperature below  $35^{\circ}$ ; and where, as is generally the case, the total depth is very great,—being very commonly 2500 fathoms, frequently exceeding 3000, not unfrequently ranging downwards to 3500, and in some instances exceeding 4000,—this stratum shows an enormous thickness, ranging from one to two miles. As the northern and southern boundaries of the Pacific basin are approached, the isotherm of  $35^{\circ}$  rises towards the surface; so that in a sounding taken by the ‘Tuscarora’ in Latitude  $43^{\circ} 21' N.$  (almost exactly the parallel of Bayonne), the surface-temperature being  $43^{\circ}$ , water below  $35^{\circ}$  was met with at less than 20 fathoms’ depth, and water of  $33^{\circ} 3$  from a depth of 50 fathoms to the bottom at 4041 fathoms; while in a sounding taken by the ‘Challenger’ in  $53^{\circ} 55' S.$  Lat., the surface-temperature being  $37^{\circ} 2$ , the thermometer sank to  $35^{\circ}$  at a little below 60 fathoms’ depth, to  $33^{\circ}$  at 70 fathoms, and thence slowly to  $31^{\circ}$  on the bottom at 1950 fathoms.

Now since the vast basin of the Pacific is virtually cut off from the Arctic basin—Behring’s Strait which forms the sole communication between the two being not only narrow, but so shallow as to be only able to give passage to the warm in-going current—and since the share in this great effect that can be attributed to the winter cold of Behring’s Sea must be comparatively insignificant, it becomes obvious that nearly the whole of the mass of almost ice-cold water which lies on the Pacific Sea-bed, must have found its way over its area from its Antarctic frigorifier, passing beneath the surface-heated stratum of the Equatorial Zone to the extreme

Northern border of the basin, and there rising from a depth of 1500 fathoms to within 100 feet of the surface.

This, it must be obvious to you, is perfectly in accordance with Physical Theory; which further explains what at first sight appears a great anomaly in the distribution of Ocean Temperature,—the immense predominance in the effect of the surface-Cold applied over a very limited area, over that of the surface-Heat applied over an area many times greater. For, as I have shown you, Cold applied to the surface is (so to speak) *wholly taken into* Oceanic water, and operates in reducing the temperature of its *entire mass*; whilst of the Heat applied to the surface, a very small proportion is operative in raising the temperature of the mass (such elevation being limited to its *superficial* stratum), by far the larger part of it being *expended in vaporisation* and being thus imparted (in a latent form) to the Atmosphere, by the currents of which it is conveyed to the remotest distances. It is thus that what Sir John Herschel termed (in the letter to which I have already referred) “the more *intense* action of Polar Cold” is produced; and in his use of this word he seems to me to have distinctly recognized the main point of my case.\*

What other possible agency than Gravitation, acting in the manner I have described, can have thus filled all the deeper part of the Pacific basin with water whose temperature unmistakeably demonstrates its Antarctic source, the opponents of what they are pleased to call the “gravitation hypothesis” have not informed us.

*Thermal Condition of Limited Submarine Areas.*—I shall now test this conclusion by the facts recently ascertained in regard to the Thermal condition of certain Submarine Areas. which, while in free communication with the General Oceanic basin as regards their upper strata, are cut off from it beneath by ridges rising to a greater or less elevation from the Sea-bed.

Let us first consider what, in an elongated trough, would be the effect of partially cutting off one end by a partition rising to any given height from the bottom, and then applying surface-cold to the other end. Supposing the whole trough to be originally occupied by water of 60° Fahr., the downward and then horizontal convection from the chilled surface will pile up on the bottom one stratum of water of (say) 40° over another. This will in the first instance be kept out of the secluded area, so that the

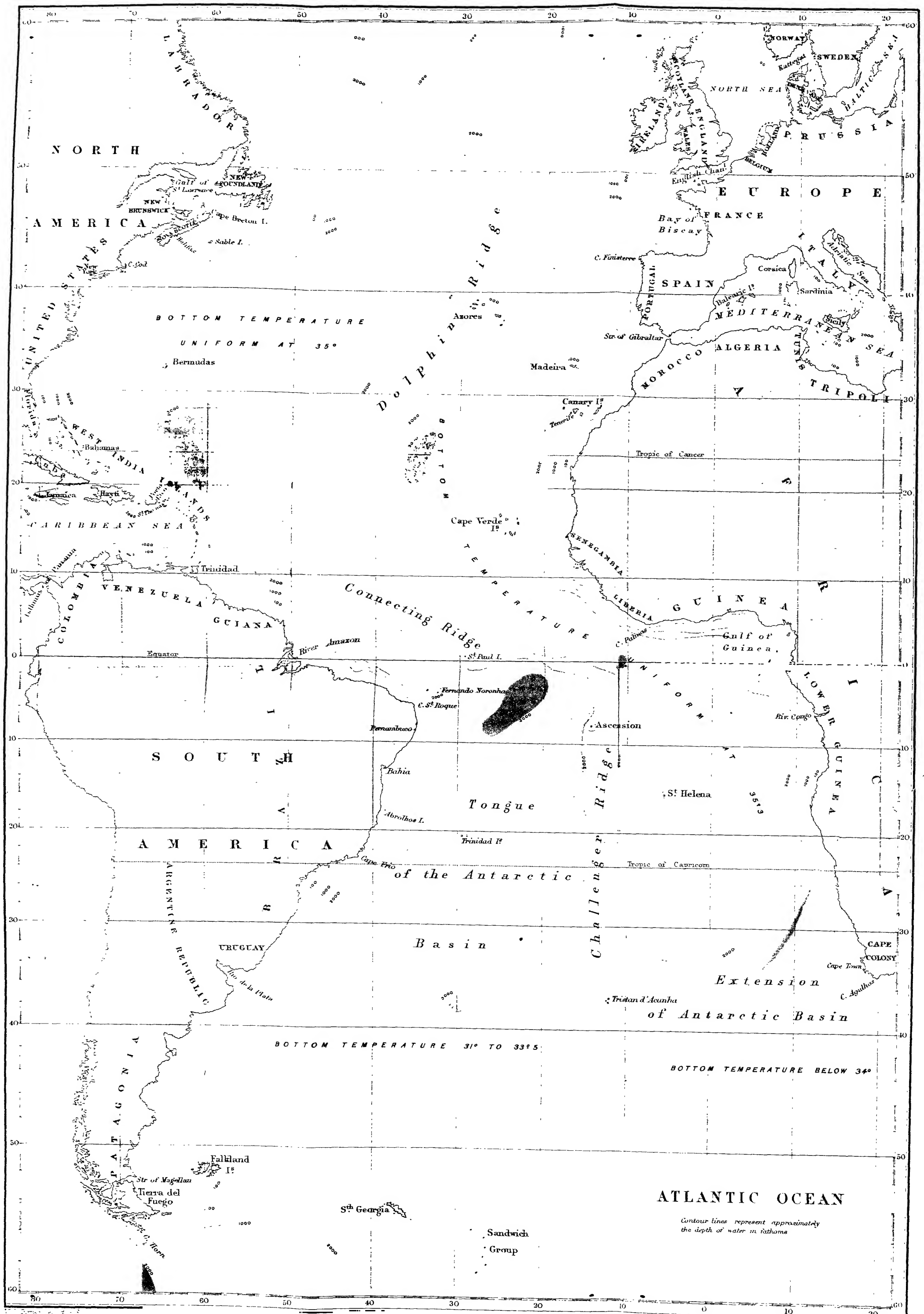
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\* “You have brought out with singular emphasis the more powerful action of “Polar Cold,—or rather the more *intense* action, as its maximum effect is limited “to a much smaller area than that of the maximum of Equatorial Heat.”

water within it will retain its temperature of  $60^{\circ}$ . But as soon as the water of  $40^{\circ}$  rises above the top of the partition, the chilled stratum will extend itself over the water in the secluded area, with which it will exchange places by gravitation; and the overflow of one stratum after another into that area will gradually replace the whole mass of water at  $60^{\circ}$  by water at  $40^{\circ}$ . Supposing, however, that by the continued application of surface-cold, the temperature of the deepest stratum were further reduced,—say to  $35^{\circ}$ , but that this reduction did not extend to the height of the partition; it is obvious that as there would be no overflow of the water of  $35^{\circ}$  into the secluded area, the temperature of its bottom and of its deeper stratum would continue at  $40^{\circ}$ —that of the coldest water that *can* enter it.

Now the Sulu Sea is a small basin lying between the north-east angle of Borneo, the south-west promontory of Mindinao, and the Sulu Archipelago. Although not ostensibly an Inland Sea, being but very partially enclosed by land, it is so surrounded by reefs and shoals, that the deeper portion of its basin, which ranges downwards to 2550 fathoms, seems to be as completely secluded from the Celebes Sea on one side, and from the China Sea on the other, as all but the superficial part of the Mediterranean basin is from that of the Atlantic. With a surface-temperature of  $82^{\circ}$  Fahr., Sir G. Nares found the thermometer fall rapidly to  $60^{\circ}$ , this isotherm being reached at about 120 fathoms; the isotherm of  $55^{\circ}$  lay at about 200 fathoms; from this the thermometer fell to  $50^{\circ}5$  in the next 200 fathoms; while from 400 fathoms to the bottom, the thermometer continued to show the uniform temperature of  $50^{\circ}5$ . (See 'Proceedings of Royal Geographical Society' for 1875, plate I., sect. vi.)—It is clear that this uniform standard of temperature cannot be determined, as is the case with the Mediterranean, by the action of Cold on the surface; for the Sulu Sea lies within  $10^{\circ}$  of the Equator, and its February mean is about  $79^{\circ}$  Fahr., so that, if there were no importation of cold water, that temperature would prevail to its greatest depths. But owing to the seclusion of the deeper part of its basin, such importation is limited to the upper stratum; and as the isotherm of  $50^{\circ}$  lies within 200 fathoms of the surface, alike in the China and in the Celebes Seas, the Sulu basin may be pretty safely affirmed to have no considerable communication with them much deeper than this. For at 400 fathoms—the depth at which the uniform temperature is first met with in the Sulu Sea—the temperature alike in the Celebes and in the China Seas, is about  $42^{\circ}$ ; and it is clear that water much below  $50^{\circ}$  must be entirely excluded from the Sulu basin.





Here, again, I am entirely at a loss to conceive by what other agency than Gravitation, this deep hollow can have possibly come to be occupied by water of  $50^{\circ}\cdot5$ , piled up on its bottom to more than 2000 fathoms' thickness. It was suggested in the first instance by Sir Wyville Thomson, that in the area of the Sulu Sea evaporation is in excess of precipitation, so that an *inflow* of water from the outside is needed to supply the deficiency and keep up its level. But this supposition is completely negatived by the fact stated by Staff-Commander Tizard, that the Specific Gravity of the water of the Sulu Sea, like that of the Celebes and Banda Seas, is *lower* than that of the surface water of the Pacific; which clearly proves an excess of precipitation over evaporation, causing an outflow instead of an inflow.

The same condition obviously determines the bottom-temperature of the Celebes and China Seas themselves. In the former, which lies nearly under the Equator, the thermometer rapidly descends, from a surface-temperature above  $80^{\circ}$ , to  $50^{\circ}$  at about 200 fathoms, and thence falls to  $45^{\circ}$  at 300 fathoms, to  $40^{\circ}$  at 500, to  $39^{\circ}$  at 600, and to  $38^{\circ}\cdot5$  at 700, continuing uniform at the last point down to the bottom at 2600 fathoms. In the latter, which lies further from the Equator, the surface-temperature is lower, and the isotherm of  $50^{\circ}$  is reached a little sooner; but the isotherm of  $45^{\circ}$  still lies at about 300 fathoms, and that of  $40^{\circ}$  at 500, as in the Celebes Sea. Below that point, however, the temperature descends somewhat more rapidly, and continues to do so down to 900 fathoms, where the thermometer sinks to  $36^{\circ}\cdot2$ , at which uniform standard it remains, down to the bottom at 1050 fathoms.

In the Banda Sea, again, which lies within  $5^{\circ}$  of the Equator, the temperature falls rapidly, from above  $80^{\circ}$  at the surface, to  $50^{\circ}$  at something more than 200 fathoms; its descent is then slower to  $40^{\circ}$  at 600 fathoms, the reduction continuing to  $37^{\circ}\cdot5$  at 900 fathoms, from which to the bottom at 2800 fathoms the temperature is found to be uniform at the same standard. This sea communicates with the Pacific only by a series of narrow channels, and seems rather to depend for its temperature upon the Arafura Sea to the south of it, the temperature of which is dominated by that of the Indian Ocean; and it is clear that a barrier exists at a depth of about 900 fathoms, preventing the admission of water of a more glacial coldness than  $37^{\circ}\cdot5$ , whilst giving free entrance to the upper stratum whose temperature is above that standard.

A yet slighter elevation of the bottom-temperature of one area above that of an adjacent area in perfectly free communication



with the Antarctic, has been attributed by Sir G. Nares with great probability to the intervention of a ridge at such a depth as would cut off only the very coldest stratum. For as the 'Challenger' proceeded directly northwards from New Zealand to the Fiji Islands, the bottom-temperature was found to be  $32^{\circ}9$  at a depth of 2900 fathoms. But in proceeding westwards from the Fiji Islands through the Melanesian Sea towards Raine Island at the entrance of Torres Strait, while the depth ranged from 1350 to 2650 fathoms, the temperature never fell below the  $35^{\circ}1$  which was reached at 1300 fathoms; and as this was the depth usually met with between the Fiji Islands and New Hebrides, Sir G. Nares considered it almost certain that the deeper part of the Melanesian Sea is enclosed by a ridge extending from Sandy Cape on the coast of Australia to New Caledonia, and thence to the New Hebrides, Solomon Islands, and New Guinea: the surface of this ridge nowhere lying at a greater depth than 1300 fathoms, while the deeper water it encloses, in the hollow between the New Hebrides and Torres Strait, is comparatively stagnant, as in the Mediterranean and other secluded seas. This conclusion was fully confirmed by the subsequent Temperature-soundings of the 'Challenger' in the nearest part of the North Pacific: which showed the prevalence of a lower temperature than that of the supposed secluded area, on the outside of its northern, as well as of its southern and eastern border.

*Bottom-Temperature of the Atlantic.*—The information now obtained with regard to the conditions of the small variations in bottom-temperature which present themselves on different parts of the great Atlantic area, makes these variations perfectly intelligible, and shows how completely they are determined by the degree of freedom with which the deepest and coldest stratum of Polar water is allowed by the contour of the Sea-bed to find its way over the several portions of the area on which these diversities are observable.

Let us take, in the first instance, the striking difference in abyssal temperature between the Northern and Southern divisions of the great Atlantic basin.—In my discussion of the Temperature-observations made in the 'Porcupine' Expedition of 1869,\* I pointed out that combining with our own observations made with 'protected' thermometers, those taken not long previously by Commander Chimmo and Lieutenant Johnson with 'unprotected' thermometers, and making the requisite correction in the latter, we

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\* 'Proceedings of the Royal Society,' vol. xviii. p. 472.



[illegible]

This is a detailed map of the North Atlantic Ocean, focusing on the Arctic region. The map shows the coastline of North America on the left, including Greenland and the Baffin Sea. The central part of the map features the Davis Strait, Denmark Strait, and the North Sea. Key geographical features include the Baffin Sea, Davis Strait, Denmark Strait, and the North Sea. Major cities and islands are labeled, such as Spitzbergen, Jan Mayen, Lofoten, and the Shetland Islands. The map also shows the coastline of North America and the Atlantic Ocean. Contour lines represent the depth of water in fathoms, with a scale from 0 to 1000. The map is titled "NORTH ATLANTIC OCEAN" at the top.

This map illustrates the North Atlantic Ocean region, focusing on the waters between Greenland, Iceland, and the British Isles. The map includes latitude and longitude lines, depth contours, and labels for various geographical features and locations. Key locations include Spitzbergen, Greenland, Jan Mayen, Iceland, the Faroe Islands, Shetland, Orkney, Hebrides, Ireland, and the British Isles. The map also shows the coastlines of North America, Europe, and Africa. A scale bar at the bottom indicates distances in miles and kilometers.

**Geographical Features and Locations:**

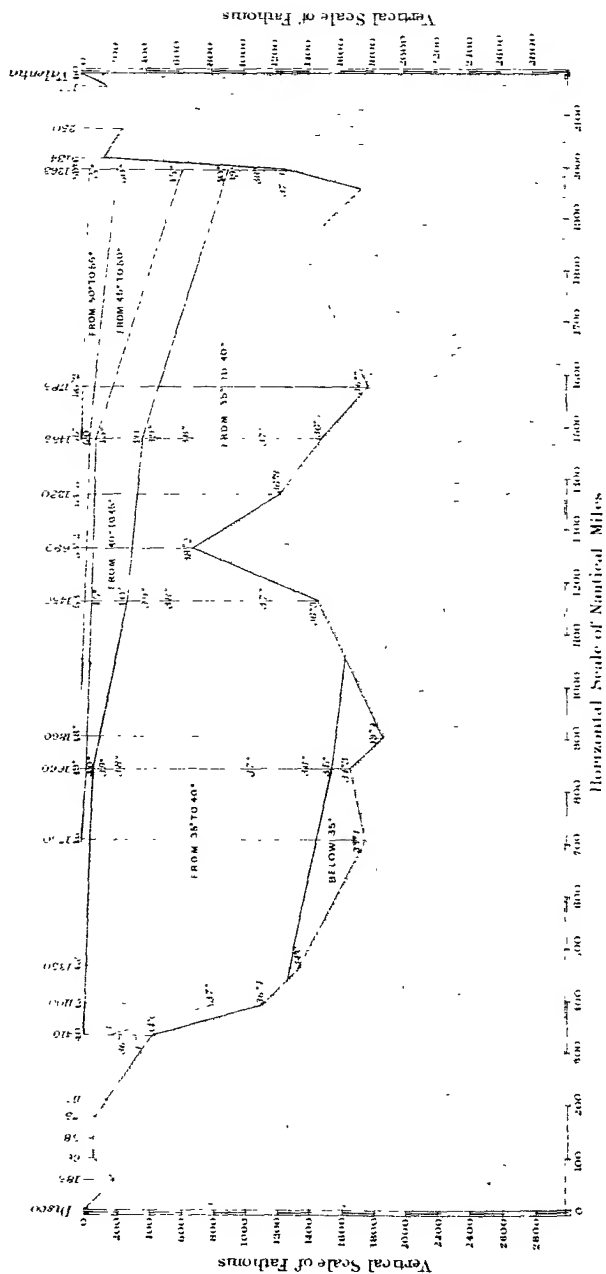
- Greenland:** Labeled vertically across the center of the map.
- Iceland:** Located in the center of the North Atlantic.
- Faroe Islands:** Located south of Iceland.
- Shetland Islands:** Located north of Scotland.
- Orkney Islands:** Located north of Scotland.
- Hebrides:** Located west of Scotland.
- Ireland:** Located west of the British Isles.
- British Isles:** Including Great Britain and Ireland.
- Spitzbergen:** Located in the Arctic region.
- Jan Mayen:** Located north of Iceland.
- Greenland Sea:** Located north of Greenland.
- Denmark Strait:** Located between Greenland and Iceland.
- North Cape:** Located on the northern tip of Norway.
- Lofothen:** Located on the coast of Norway.
- Bank of Newfoundland:** Located off the coast of North America.
- English Channel:** Located between England and France.
- Dogger Bank:** Located in the North Sea.
- Rockall:** Located in the North Atlantic.
- Valentia:** Located off the coast of Ireland.
- Porcupine Bank:** Located off the coast of Ireland.
- Line of Sackham from Disco to Valentia:** A line drawn across the North Atlantic.

**Depth Contours:** The map shows depth contours in fathoms, with labels such as 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000.

**Scale:** The scale bar at the bottom indicates distances in miles and kilometers.



# SECTION OF NORTH ATLANTIC OCEAN BETWEEN DISCO & VALENTIA



W. & A. Johnston

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might estimate the general temperature of the deeper parts of the *North Atlantic* at about  $35^{\circ}$ ; the reduction to this point being determined by the flow of glacial water in limited amount from the Arctic into the North Atlantic basin. But I further pointed out (p. 473), that the unrestricted communication which exists between the *Antarctic* area and the *South Atlantic* basin would allow a much larger body of cold water to pass from the former into the latter; thus producing a reduction in the temperature of the deepest parts of the South Atlantic below that of the abyssal depths of the North Atlantic—probably to  $32^{\circ}$  or lower; and not improbably carrying a temperature of  $32^{\circ}$  as far as the Equator, or even to the north of it.

These predictions have been fully verified by the 'Challenger' temperature-soundings. For (1) the abyssal temperature of the North Atlantic was everywhere found to range between  $35^{\circ}$  and  $36^{\circ}$ ; except either in the passage to Halifax, N.Sc., where a slight depression was observable, which might fairly be attributed to the nearer approach to the source of the Arctic underflow; or in the neighbourhood of the Equator, where the influence of the Antarctic underflow made itself apparent. In the western half of the South Atlantic, on the other hand, the Sea-bed is covered by an abyssal stratum of water of several hundred fathoms' thickness, the temperature of which ranges downwards from  $35^{\circ}$  to  $31^{\circ}$ ; and this not only extends as far as the Equator, reducing the bottom-temperature between St. Paul's Rocks and Fernando Noronha to  $32^{\circ}\cdot4$ , but seems traceable as far north as the neighbourhood of St. Thomas's, where the thermometer indicated a reduction of nearly a degree below the general Bottom-Temperature of the North Atlantic. (See Chart of Atlantic.)

Again (2) the *rationale* which I suggested for the higher bottom-temperature of the North Atlantic, has been fully borne out by the recent Temperature-soundings of the 'Valorous.' The principal, indeed almost the only direct channel of communication between the deeper parts of the Arctic and the North Atlantic basins, is in the interval between Greenland and Iceland; for between Iceland and the Faroe islands there is a shallow ridge over which no glacial water can flow; the 'Lightning Channel' between the Faroe and Shetland islands cannot give passage to any large body of glacial water; and the shallowness of the North Sea between Shetland and the shore of Norway makes it as it were a coast-line to the deeper water of the Arctic basin. Now, whilst near the mouth of Davis's Strait, and for some distance to the S.E. of Cape Farewell, the Temperature-soundings of the 'Valorous' (see Section) showed

that at depths exceeding 1660 fathoms, the bottom-temperature ranged downwards to  $33^{\circ}4$ , it rose to  $36^{\circ}3$  with an elevation of the bottom to 1450 fathoms, while on the summit of this elevation, which lay at only 690 fathoms' depth, it was  $38^{\circ}2$ . To the north of this elevation, again, there is evidence of another yet shallower ridge, reducing the depth of the "Denmark Strait" between Iceland and Greenland to less than 500 fathoms. And thus, the passage of water below  $35^{\circ}$ , in any considerable quantity, from the Arctic into the North Atlantic basin, being effectually barred, we see a complete explanation why the temperature of the latter only falls beneath  $35^{\circ}$  where Antarctic water spreads itself over its Sea-bed. Since, again, a perfect continuity can be traced, except where the passage of the deeper strata is interrupted by submarine ridges, between the Thermal stratification of the North Atlantic and that of the Arctic basin, I can see no reason whatever for supposing that the temperature of the North Atlantic is modified in any sensible degree by an Antarctic underflow, beyond the limit to which this can be distinctly traced by a depression of bottom-temperature below  $35^{\circ}$ . (See Chart of Northern Atlantic.)

But further, there is a marked difference between the Bottom-Temperatures of the *western* and of the *eastern* portions of the South Atlantic Sea-bed; that of the latter, between Tristan d'Acunha and Ascension island, nowhere falling below  $35^{\circ}3$ , though between Ascension island and the Equator there is a narrow but deep stratum of water ranging downwards between  $35^{\circ}$  and  $32^{\circ}7$ , which must obviously be an extension from the Antarctic basin. This extension is clearly traceable on the line between Tristan d'Acunha and the Cape of Good Hope; the bottom-temperature ranging downwards to  $32^{\circ}9$ , and a considerable thickness of abyssal water having a temperature below  $35^{\circ}$ .—Now this distribution of abyssal temperatures is precisely conformable to the contour of the Sea-bed; for the "Dolphin Ridge," which divides the North Atlantic into an eastern and a western basin, seems to have its parallel in the 'Challenger' ridge of the South Atlantic; the two being connected by an oblique ridge that lies about halfway between the Guiana coast and the opposite Guinea coast (see Chart of Atlantic). And while the *western* basin is in free communication with the Antarctic, so that its glacial water flows northwards until checked by the 'connecting ridge,' the deep communication of the Antarctic with the *eastern* basin is so far interfered with, that very little of the glacial water of the former can find its way along the bottom of the latter, which consequently receives only the coldest that can flow over the ridges.

Here, again, we have a remarkable illustration of the prescience of the profound Physicist, whose early acceptance of my views I felt to be my greatest encouragement in the pursuit of this enquiry. After pointing out that the causes of the Wind (or horizontal) Circulation lie on the surface,—none of the agencies escaping our notice, and the configuration of coasts, which mainly determine their direction, being patent to sight,—he continues:—“It is otherwise with the other class of movements [those which “depend on Heat, Cold, and Evaporation as *veræ causæ*]. They “take place in the depths of the Ocean; and their movements, and “directions, and channels of concentration are limited by the configuration of the sea-bottom, which has to be studied by the very “imperfect method of sounding.”\* If Sir John Herschel had lived to see the series of Temperature-Sections that have been worked out by my old shipmate Staff-Commander Tizzard, from the Serial Soundings taken in the ‘Challenger’ under the direction of Sir George Nares and Captain F. T. Thomson, he would, I feel sure, have not only accepted them as constituting by far the most remarkable single contribution to the Physics of the Earth that has ever been made; but would have recognized the perfection to which this method of observation has now been carried by the able Officers who had charge of it, the skill with which their results have been correlated, and the soundness of the conclusions to which they have been led, as to the relation between the distribution of the Bottom-Temperature and the configuration of the Deep Sea-bed.

*Confirmation of Gravitation-Doctrine by Mr. Froude's Investigations.*  
—Since I last brought this subject before the Royal Geographical Society, the theoretical considerations on which I based my argument have received most weighty confirmation. It has been affirmed, over and over again, by Mr. Croll and others, who maintain that the distribution of Bottom-Temperature essentially depends on surface Wind-currents, that deductions from Laboratory-experiments on water in small troughs, are not applicable to great Ocean-basins; for that if we had a trough of the length of a quadrant of the earth's surface (say  $\frac{25}{4} \times 100$  miles, = 6250 miles) and a depth of (say) 3 miles, the continued application of ice to the surface at one extremity along one-tenth of its length, would *not* occasion the transmission of Cold by horizontal convection to the opposite extremity,—the disturbance of Thermal and therefore of Static Equilibrium thus produced, being quite inadequate to put the contents of the trough in movement along its whole length. No other evidence of this inadequacy, however, has ever been adduced,

\* ‘Proceedings of Royal Geographical Society,’ vol. xv. p. 212.



than a computation based on the experimental results obtained by M. Dubuat, a French Engineer, in regard to the gradient required to produce a *definite current in water moving over solid surfaces*. But, as I pointed out some years since,\* these experiments are not applicable to the very different case of a *slow movement of water over water*: for if water be a *perfect fluid*, the smallest disturbance of equilibrium in any part of it will give rise to movements tending to its restoration; and in proportion to its approximation to that perfection, will be the facility with which it will be thus put in motion.

Now what is known as the 'Stream-line Theory' elaborated by the mathematical investigations of Prof. Stokes, Sir William Thomson, the late Prof. Macquorn Rankine, and other eminent Mathematicians, has, so far as it relates to the motion of ships through water, been recently made the subject of thorough experimental enquiry by Mr. Froude; who, in the masterly Address which he delivered as President of Section G at the Meeting of the British Association in 1875, gave it as the result alike of theoretical and of practical investigation, that in estimating the forces which impede the progress of a vessel through the sea, *the friction of the particles of the water it displaces, upon each other and upon those of the surrounding water*, exerts so small a retarding influence, in comparison with their friction against the solid surface of the ship, the opposition of the bow- and stern-waves which are raised when the ship is rapidly urged through the water, and the loss by the production of eddies when its form is unsuitable, that it *may practically be thrown out of consideration*.

As this conclusion seemed to me to have an important bearing upon my own subject of enquiry, I brought the question under Mr. Froude's attention; and found him fully prepared to endorse my views, not only on general grounds, but also because they are in complete harmony with the results of enquiries he has himself prosecuted in a line exactly parallel to my own. For having had occasion frequently to observe the movement of water in harbours, lochs, and fiords, communicating with the sea at their mouths, but at the same time receiving enough fresh water from the land to lower the salinity of their upper-stratum, and to produce a slight surface-outflow, he had always been able to detect a deeper flow of Sea-water into the interior basin. And since this inflow can be attributed to nothing else than a very slight excess of downward and therefore lateral pressure in the *outside column*, depending on the continually-maintained reduction in the mean salinity of the

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\* 'Proceedings of Royal Society,' 1872, p. 552.

*inside* column,\* a similar horizontal convection-movement will equally take place when the disturbance of Static Equilibrium is produced by changes of Temperature.

*Summary.*—The general conclusion, then, towards which all the foregoing facts converge, is that the Bottom-Temperature of Oceanic Basins and of partially-inclosed Seas essentially depends on two factors:—(1) *downward* Convection-movements of their superficial strata, carrying to the bottom the Cold applied to their own surface;—and (2) *horizontal* Convection-movements of their deep strata, carrying the Cold applied to the surface of one area to other areas at remote distances from it. The horizontal, equally with the vertical Convection-movements, are necessary results of the constitution of Liquids; since, as their pressure is equal in all directions, a heavier (because colder) body of water has precisely the same tendency to displace lighter water by a horizontal flow, as it has by vertical descent. In a Sea entirely cut off from the Oceanic area, and not subject to any considerable local diversity of surface-temperature, the Bottom-Temperature will correspond pretty closely with the Isocheimal, or mean Winter-temperature, of the surface; and this condition will not be essentially changed by the admission of water from the Oceanic area, belonging to a stratum sufficiently near the surface to bring in a temperature not below the Isocheimal,—as happens in the Mediterranean and Red Seas. But where, as in the Sulu, Celebes, Banda, and China Seas, admission is given to water colder than the Isocheimal, the Bottom-Temperature is that of the coldest water thus admitted. And while, in the Polar areas of the great Oceanic basin, the glacial temperature of the Bottom is determined by *downward* Convection alone, the extension of that glacial temperature over the whole remainder of the basin depends on *horizontal* Convection; its slight variations being determined by the contours of the Sea-bed, which exclude the deepest and coldest flow from particular tracts. Finally, I venture to affirm that the doctrine of the essential dependence of the Bottom-Temperature of the several parts of the great Oceanic basin, on the degree of their accessibility to the horizontal flow of Glacial water from the Polar areas under the influence of Gravitation, is so completely conformable, on the one hand with Physical Theory, and on the other with the facts established by careful and extended observation, as to have a claim for unhesitating acceptance as one of the established verities of Physical Geography.

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\* Those who have followed the course of my previous enquiries, will recollect that it was precisely in this manner that I explained the inward under-current of the Baltic, and predicated that of the Bosphorus and Dardanelles.

*Eleventh Meeting, 14th May, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATIONS.—*Richard Jeffs, Esq.; Edward Herries, Esq.*

ELECTIONS.—*James Crispe, Esq.; Frederick Day, Esq.; Thomas Bradley Dickinson, Esq.; John Dickson, Esq.* (H. M. Vice-Consul at Beyrout); *Rev. John Griffiths; John Husband, Esq.; John H. B. Lytton, Esq., M.A.; Alexander Scrutton, Esq.; John Hewitt Tomlin, Esq.; Harold J. B. Torry, Esq.* (Lieut. Royal London Militia).

DONATIONS TO LIBRARY, APRIL 23 TO MAY 14, 1877.—The following portions of the publications of the scientific results of the Voyage round the Earth of the Austrian Frigate *Novara*, 1857–1859, required to complete the copy in the Society's possession:—*Nautisch-physicalischer Theil*, and *Kartenrolle*, *Medizinischer Theil*, *Botanischer Theil*, *Anthropologischer Theil*, *Abth. i.*, and *Zoologischer Theil*, vol. i., and vol. ii. part 1, Sections A and B, and parts 2 and 3 (*The Imp. Academy of Sciences, Vienna, per Herrn Hofrathe Dr. Ritter von Hochstetter, K. K. Ministerium für Cultus und Unterricht, on the application of Dr. Karl von Scherzer*). General Report on the operations of the Great Trigonometrical Survey of India, 1875–76 (*The Indian Government*). Imp. Meteorological Observatory, Tokei, Japan, table for 1876, with Introductory remarks, and Progress, &c., of Meteorology, Japan, by H. B. Joyner (*Author*). The best trade-route to the Lake regions of Central Africa, by E. Hutchinson (*Author*). *Annales hydrographiques*, No. 571, and Sér. D., No. 219 (*The French Minister of Marine*). Reclus' *Nouvelle Géographie Universelle*, vol. ii. (*Author*). The Grotto Geyser of the Yellowstone National Park (*Dr. F. V. Hayden*). *Neues aus der Geographie, Kartographie und Statistik Europa's und seiner Kolonien*, vii., 1877 (*The R. General Staff, Berlin*). The Franco-German War, 2nd part, 10th Section, translated by Captain F. C. H. Clarke (*H. M. Secretary of State for War*). *Rapport sur la Mission des Chotts, Mer intérieure*, par M. le Capt. Roudaire, and *Rapport sur le service des Missions et voyages scientifiques en 1876*, par M. le Baron de Watteville (*The French Geographical Society*). *Ponts et Chaussées, Service Hydrométrique du bassin de la Seine; Résumé des observations pendant 1875*, and *Observations sur les cours d'eau et la pluie pendant 1875*, par E. Belgrand et G. Lemoine (*The Department*). *Portugal e o movimento geographico moderno*, por L. Cordeiro (*Author*). *A Sociedade de Geographia de Lisboa e o Marquez de Sá de Bandeira*, por R. A. Pequito (*Author*). *Armenia and the Armenians*, by J. Issaverdens, 2 vols., and *Les*

Assises d'Antioche, reproduits en français (*The Armenian Academy of St. Lazarus, Venice, from Prof. Léon Alishan, per S. Baronian, Esq.*). Floods in the Thames Valley, by F. J. Palmer (*Author*). Interlaken et ses environs, par P. Ober (*Librarian R. G. S.*) Description physique de la République Argentine, par H. Burmeister, traduite par E. Daireaux, vol. ii. (*Dr. H. Burmeister*). Financial Statement of Colonial Treasurer of New South Wales, 1877 (*The N. S. Wales Government*). Le Pamir, par J. B. Paquier (*Author*). And the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO THE MAP-ROOM BETWEEN 24TH APRIL AND 14TH MAY, 1877.—Map of routes travelled and discoveries made by the exploring expeditions under the command of Ernest Giles between 1872–6 (*H. M. Secretary of State for the Colonies*). Preliminary map of Eastern Turkestan; map of the Pundit's route from Ladakh to Assam, 1874; and map of the Havildar's route from Afghanistan. &c., and the Mullah's route from Jalalabad to Sarhadd-i-Wakhan. 1873–4 (*Capt. H. Trotter, R.E.*). Map of North-East Africa and Arabia; photograph (*General Stone, Chief of General Staff, Egyptian Army*). Map of Aberdeenshire, &c.; map of Forfarshire, &c.; Johnston's Political map to illustrate "The Eastern Question;" war map of Turkey in Europe: and war map of Turkey in Asia and Transcaucasia (*Messrs. W. and A. K. Johnston, publishers*). Map of Nippon (Japan). Yezo, &c., by R. H. Brunton, M.I.C.E., F.R.G.S., Trübner, Ludgate Hill (*Author*).

The PRESIDENT said the Paper to be read gave an account of the remarkable journey of Nain Singh across Tibet in 1874–5, and was drawn up by Captain H. Trotter, R.E., Deputy Superintendent of the Trigonometrical Survey of India. It was Captain Trotter's intention to have given the Paper a wider scope, by including in it several other recent explorations in Central Asia, which had been carried out under his superintendence, or by himself personally, viz. the journeys of two other *employés* of the Trigonometrical Survey, surnamed "the Havildar" and "the Mollah," through previously unknown parts of Western Turkistan, and his own important explorations north of Kashgar and across the Pamir Steppe. He had, however, suddenly received orders to proceed on service to the East, and had been unable, in consequence, to finish the Paper in time for the present Meeting. It was fortunate that the journey of Nain Singh could be given with considerable completeness, this being of some interest to the Society at the present time, as the Council had recently awarded to the Pundit the Patron's Medal for his meritorious explorations.

*Account of the Pundit's Journey in Great Tibet from Leh in Ladákha to Lhása, and of his Return to India via Assam.* By Captain H. TROTTER, R.E.

[ABRIDGMENT.]

NAIN SINGH, the explorer who undertook this journey, is the original Pundit whose journey to Lhása in 1865 from Katmandhú,

the capital of Nepál, was described at length by Colonel Montgomerie, R.E., in the 'Trigonometrical Survey Reports' for 1866-67. The Pundit had been in the service of the brothers Schlagintweit while they were carrying on magnetic and other scientific observations in Ladákh and Kashmir in 1856 and 1857; he was subsequently appointed Head-master in a Government Vernacular School in his native district of Milam in Kumaon, and remained in the Education Department until 1863. when, at the instance of Colonel J. T. Walker, R.E., the Superintendent of the Great Trigonometrical Survey, he was entertained for employment as a Trans-frontier explorer and duly trained. From that time to the present he has been constantly engaged either in carrying on explorations himself, or in training other natives to follow in his footsteps. In 1865-66 he made the famous journey, alluded to above, from Katmandhú to Lhása, and thence to the Manasarowar Lake and back to India. This exploration earned for him the present of a gold watch from the Royal Geographical Society of London, which, unfortunately, was subsequently stolen from him by one of his own pupils. In 1867 he went in charge of a party of natives, and did excellent service in exploring and surveying the head-waters of the Sutlej and the Indus rivers. In 1870 he was deputed to accompany Mr. (now Sir Douglas) Forsyth's first mission to Yárkand, but shortly after the Mission left Leh he was sent back to India. In 1873, he was sent under Captain Trotter's orders with Sir Douglas Forsyth's second mission to Yárkand, in connection with which he did much good service. In July 1874, while at Leh, after the return of the Mission, the Pundit having volunteered to make a fresh exploration, Captain Trotter was authorised by Colonel Walker, R.E., to despatch him on the journey to Lhása now to be described. His instructions were to proceed by a much more northerly route than the one he had previously followed. From Lhása he was to endeavour to get attached to the caravan which proceeds thence every three years to Pekin. If he failed in accomplishing this, he was to endeavour to return to India by an easterly route from Lhása, down the course of the Brahmapútra if possible.

On the 15th July, 1873, the Pundit and his companions left Leh. On the 21st they reached Tánksé, three marches further on; at Chágra, they found a summer-encampment of shepherds, the last inhabited spot on the road to Yárikand.

From Chágra they followed the Changchenmo route to Yárikand, halting at the foot of the Lankar or Marsemik Lá (Pass). On the following day they crossed the pass (18,420 feet high) and then quitted the Yárikand road, and turned off to the east; crossed the

Kiu Lá, still higher than the Marsemik, and encamped for the night at Pángur Gongma, after a march of 9 miles.

The Pundit was obliged to travel slowly, as the whole of his worldly possessions—including tent, bedding, and commissariat for the whole party—had to be carried on the backs of sheep. It is astonishing what admirable beasts of burden these animals make in a pastoral country. The Pundit started with twenty-six sheep from Tánkse. Of these some were eaten on the road, some became ill and were exchanged for fresh ones; but four or five of the original lot reached Lhása, having, in less than four months, carried loads of from 20 to 25 lbs. each, over a distance of more than 1000 miles. Throughout the journey they never received a single ounce of food beyond what they could pick up for themselves on the road and at the camping-grounds.

On the 28th of July the party descended to Ningri, and on the following day reached Niágzu Rawang.

From Niágzu six short marches brought our travellers to Noh. The country through which they passed was almost uninhabited; a few solitary tents belonging to the Noh shepherds, and a single hut, occupied by a frontier guard, were the only inhabitants passed *en route*.

Noh is a small village in the Rudokh district, containing about twenty huts, built of stones cemented by mud. It has a small permanent population, which is increased largely in the winter months by numerous shepherds, who during the summer are scattered in tents in twos and threes, in whatever parts of the district grass and water are to be found in sufficient abundance for their numerous flocks of sheep and goats.

The province of Western Tibet is frequently termed Nari Khursum. The inhabitants of the northern portion, i.e. the district through which the Pundit travelled, are called by the settled population to the south Champas or *Changpas*, i.e. literally, *North-men*. By the inhabitants of Turkistán they are called *Tághlik* or mountaineers. The Champas encountered by the Pundit were, contrary to the generally received opinion of them, quite inoffensive people, of the same class as the people of Rudokh and the more civilised districts farther south. They are all Buddhists.

The road near Noh skirts the Pangong Lake, which at Noh is joined by a stream from the north-east, up which goes a good road to Khotan, *viâ* Polu and Kiria.

The distance to Khotan by this road is about 450 miles. For a distance of 40 miles from Noh it gradually rises up to a height of 15,500 feet; and then, for about 160 miles as the crow flies, crosses,

in a north-easterly direction, a series of elevated plains and ridges before it descends somewhat suddenly to the plains of Eastern Turkistán. The average height above sea-level of the halting-places, on the elevated plain to the north of Noh, is 16,500 feet. This vast highly-elevated plateau, over which the road passes, is the eastern continuation of the Ling-zi-thang and Áksu Chin plains, which lie at a similar, or in places even a higher, elevation in a north-westerly direction from Noh, between the Changchenmo River and the Kuen Luen Range, and have to be crossed by the traveller who adopts the eastern (or Changchenmo) route between Leh and Yárkand. To the north of the Kuen Luen there is a rapid fall into the plains of Eastern Turkistán.

The Tibetan plateau extends eastward as far as the head-waters of the great rivers which water China—up, in fact, for a distance, as the crow flies, of more than 800 miles to the Bourhan Búda Mountains (south-west of the Koko-Nur Lake on the road between Lhása and Pekin), where, according to the Abbé Huc, and the still more recent researches of the Russian Captain Prejevalski, a table-land rises from 14,000 to 15,000 feet above the sea-level, above which tower gigantic snow-covered mountains.

Seven miles to the east of Noh is the eastern termination of the series of lakes known to us as the Pangong. Its extreme length is exactly 100 miles, while its breadth probably nowhere exceeds six or seven.

At its eastern extremity it is entered by a small stream, 3 paces broad and  $1\frac{1}{2}$  foot deep. Although the greater portion of this lake has been previously surveyed and described, its eastern limit has now been determined for the first time. It is a curious fact that the water at the eastern extremity is sweet and good to drink, while that at the west end is very brackish. It has been conclusively shown by Major Godwin-Austen that this lake once upon a time drained into the Shyok, but at present it forms the most western of a numerous series of inland lakes with no outlets, which we shall find stretch for a considerable distance across the elevated plateau of Central Tibet.

From Noh the Pundit toiled on for many weary marches over this Tibetan plateau; his road lay eastward along a wide, open grassy valley, varying in width from 6 to 10 miles, bounded on the north and south by low grass-covered hills, through which occasional openings gave a view of extensive plains stretching away as far as the eye could reach. Beyond the hills sometimes appeared snow-capped mountains; while an occasional shepherd's tent in the foreground, and the frequent appearance of large herds of wild

asses, antelope, and gigantic wild sheep, helped to relieve the monotony of the journey. In almost every day's march large sheets of water were passed, generally salt, but occasionally fed by fresh-water springs. At the latter, the Pundit and his companions would fill their water-skins, as they rarely knew from day to day whether or no they would be able to obtain a fresh supply on the road. More than once their supply of this precious fluid was exhausted, and on one occasion the whole party were for more than twenty hours without fresh water. For fuel, also a traveller's necessary, they were better off; the *argols*, or dung of the numerous flocks of wild animals, were a never-failing source of supply, while occasionally, but rarely, firewood was obtained in considerable quantities. At Tchachap Cho, a fresh-water lake, 8 miles to the east of Noh, and the 27th halting-place from Leh, a large stream flowing from some snow-covered hills to the north-east of the lake was found to be covered on both banks with a dense forest of willow, tamarisk, and other trees and shrubs. For the first thirty marches from Noh the heights of the camping-grounds varied between 13,700 and 15,000 feet, and for the rest of the journey to Namcho the ground was somewhat higher; but there was no considerable rise or fall throughout this portion of the Pundit's route. The large, flat, open valleys traversed by the Pundit, locally termed *Sangs*, appear to be much of the same nature as the *Pámirs* between Eastern and Western Turkistán, and the *Jilgas* of Northern Ladákh. These *Sangs* of Tibet, however, would seem to have more of plain and less of precipitous mountains than either the *Pámirs* or the *Jilgas*.

The Khámpas of this plateau had migrated from their own country (near Ziling to the east of the Koko-Nur Lake) about twenty-five years prior to the Pundit's visit. They travelled *viá* Lhása and the Manasarowar Lake, near which place they plundered a caravan, and fled with their booty to their present camping-grounds, which, prior to that time, were uninhabited. Soon after settling there, they were called on by the Garpon of Gártokh to pay tribute, which they now do annually to the extent of 5000 Nák-tang or Tankas, *i.e.* about rupees 2000 (200*l.*), or its equivalent in gold, ghi, horses, and cattle. This tribute is paid in Gártokh, and a punctual payment doubtless secures a certain immunity from their peccadilloes being inquired into. They possess large herds of cattle, &c., each tent possessing from ten to sixty horses, and from 500 to 2000 sheep. They despatch annually to a fair at Gáni-ma, near Manasarowar, large quantities of sheep and goats'-wool, salt, and gold; and, according to their own account, when they have finished



their mercantile transactions, they send back the cloths, &c., that they have purchased, under the escort of the older and less active members of the tribe, while the young men start on some marauding excursion, the victims of which are generally travellers and strangers to the country. The Khámpas are well armed with guns and swords, which latter are constantly worn even by boys. The scabbards are often handsomely ornamented with gold, turquoises, and coral.

The men are fine, large, broad-shouldered fellows. They wear, both in summer and winter, *postíns* made of sheep-skins, the hair being turned inside. These coats are worn short, extending to the knees only, and are fastened round the waist by a woollen girdle, above which the coat is roomy and capacious, affording ample space for the storage of their goods and chattels when on a journey. They have felt hats, resembling in shape a broad-brimmed English *wide-awake*, and leather boots with woollen tops and curved pointed toes. They have no hair on the face, and that of the head is plaited, Chinese fashion, into pigtails. The women dress very much as the men, but their *postíns* are longer and less roomy. They wear round leather caps and very long hair, to the plaits of which are fastened long pendants, nearly reaching the ground, profusely ornamented, chiefly with silver coins, of which the favourite is the British *rupee*. Both men and women are always in the saddle; they ride large, powerful horses, and both sexes are skilful riders. They are great sportsmen, and kill large quantities of game, chiefly wild horses, sheep, and antelope. They either employ firearms, or kill their prey with swords and spear when caught in a trap. Their capacity for eating meat appears to be unbounded, and they are apparently naturally somewhat bloodthirsty; as the Pundit states that on several occasions when an animal had been killed, he saw the Khámpa boys kneel down and lick the blood off the ground. This fondness for blood would appear to be derived from a still earlier age, as the food given to infants, when their mothers can no longer support them, consists, in the entire absence of grain in the country, of pounded cheese mixed up with butter and blood. They are of the Buddhist religion; but their language is quite different from that of other Tibetans, and only one man of the Pundit's party, who had resided some years at Sining-fu (to the east of the Koko-Nur) was able to understand it, and to make himself understood.

Between Gargethol and the Champa district of Shankhor on the south is a place called Gegha, where a large fair is annually held in July and August.

On the 29th of August the Pundit returned to Hissik Cháka, where he saw a large herd of *kiánga*s, wild horses, fully 200 in number. He continued his route over uninhabited level plains, till the 1st of September, when, at a camp called Humacho, he met on the road the Gombo of Garchethol, a gentleman who was distinguishable from his followers in that he wore a pair of golden earrings of such length as to rest on his shoulders. The presentation of the letter of introduction from their medical friend at Garchethol secured our party a civil reception.

The following night there was a sharp frost, the first sign of the approach of winter.

On the 3rd of September they reached the village of Mango, the head-quarters of the Gombo, who had gone on ahead of the travellers. The Pundit paid him a formal visit in his tent—a large one made of yák's hair—and made him a small present of sandal-wood. The Pundit was kindly treated, and on intimating to the Gombo that he was on his way to visit a celebrated monastery near the Namecho Lake, Chiring Dunduk (the Gombo), said he was himself about to move his camp several days' march in that direction, and proposed that they should perform the journey together. The Pundit gratefully acquiesced.

Among other visitors was an old man named Sonám Darka, about eighty years of age, a native of a country near Lhása, who had been living as a servant amongst the Khámpas for several years, and had gradually accumulated a good deal of property. The Pundit, when he found that this man could speak good Tibetan, succeeded in securing his friendship by the present of a couple of common sewing-needles, and obtained from him the following information about the neighbouring countries:—

Sonám Darka had on one occasion, some thirty years ago, made a journey from Thok Daurákpa to Ájan, a country about two months' journey in a north-easterly direction. The road lay throughout over an extensive plain, no large mountains being seen, or streams encountered *en route*. Drinking-water was obtained from a succession of small fresh-water lakes, mostly supplied from rain-water. Shortly before reaching the Ájan country, the road traverses a bare rocky range of mountains. Ájan itself was inhabited by the Sokpo Kalmucks, a nomadic pastoral people who obtained grain (rice and flour) from the neighbourhood of Karka, a large monastery said to be ten or twelve days' journey beyond the southern frontier of the Ájan country. Near Karka is a large city called Kokod, the residence of the ruler of the Sokpo districts, while Karka itself contains several monasteries, one of which is the residence of the

spiritual head of the Sokpo Kalmucks. The road just described is never now made use of, on account of the difficulty of ensuring a certain supply of water *en route*; no one would venture to travel by it unless after an unusually heavy rainy season. Wood and grass are said to be plentiful throughout.

Karka is a name about which I have for some time past been endeavouring to obtain authentic information, but I can hardly venture to claim any great success in the attempt. It is first mentioned, as far as I am aware, by Major Montgomerie, R.E., in his discussion of the work of the Pundit, who explored the Namcho Lake in 1872. On the present occasion the Pundit had been specially instructed to make inquiries about it. He saw in Lhása some men who were pointed out to him as from Karka, tall, copper-complexioned, fine-looking men, but, unfortunately, he could not understand their language, and his stay in Lhása was so short that he was unable to learn anything authentic about them.

As far as I can gather from inquiries made at Yárkand, and from information collected by the Pundits, Karka is situated about one and a half month's journey to the north-west of Ná-k Chu Kha, a large village situated on a river of the same name a few marches to the north-east of the Tengri-Nur or Namcho Lake. At this village it is said that two roads diverge; one to Karka, passing in a north-westerly direction, and the other to Koko-Nur and Pekin in a north-easterly direction. The position of Karka thus obtained would agree approximately with an account I heard from a Kalmuck in Kashghár, which located Karka at about a fortnight's journey to the south-east of Lake Lob. It probably lies somewhere between Lakes Lob and Koko-Nur, and I think it not improbable that the country of Ájan to the south of it may be the same as the country of Anj Si which is mentioned by *Uspenski* in the Russian *Investigia* as a country lying in a westerly direction from the Zaidan Plain, which is to the west of Koko-Nur.

On the 4th of September the Pundit left Mango, in company with Sonám Darka, and the Gombo Chiring Dunduk, the headman of Garché, together with their flocks and herds; there were about six tents of Nomads in all. For four days they kept company, advancing slowly at the rate of about 8 miles a day. It is the habit of these people, when they have exhausted the pasturage near any one camp, to shift bodily to fresh ground; they were now on one of their customary moves. On the fourth day they reached Kezing, in the neighbourhood of which place are very extensive pastures, sufficient for the subsistence of the Gombo's large flocks for a couple of months.

Some idea of the wealth of this people may be inferred from the fact that one of the headmen was himself the fortunate proprietor of 50 horses, 400 yáks, and 2000 sheep. Other members of his tribe were said to be even more wealthy than he.

These Garché Khámpas, numbering in all about 100 tents, had only been settled in the country for about fourteen years. They are under the jurisdiction of the Gyalpo of Lhása, and are very much better off than their neighbours the Gargé Khámpas (who are under Rudokh), as they only pay what must be to them an almost nominal tribute (in gold) of the value of about 20*l*. This gold is obtained at Thok Daurákpa, to the east of Garchethol, in exchange for the produce of their flocks, and for borax, extensive fields of which exist at Noring Cho, which were passed by the Pundit *en route* to Kezing.

The Pundit appears to have ingratiated himself most successfully with the Gombo Chiring, for that chief very kindly made arrangements that he should travel onwards with two other men, servants of a merchant from the neighbourhood of Shigátzé, who were travelling with some spare yáks in advance of their master from Thok Jálung to Shigátzé. These men, for their own sakes, were only too happy to travel in company with the Pundit and his party.

From Kezing eastward for a distance of 80 miles, up to Thok Daurákpa, the country was uninhabited when the Pundit passed through it; but it is occupied by the Khámpas of Garché at certain seasons of the year. There is capital grazing and an abundant supply of water and fuel (argols) throughout. The road lies the whole way in one of the broad open *sangs* before described, lying between ranges of hills running east and west. South of the Tashi Bhup Cho, the southern range runs off in a south-east direction, rising rapidly in height and forming a massive group of snow-covered peaks, the positions of several of which were fixed by the Pundit, although at a distance of from thirty to forty miles south of his road.

From this snowy group flows northwards a very considerable stream, the Shyal-chu, which was crossed by the Pundit in three separate branches, which, although nowhere more than a foot in in depth, are said to be passable only with very great difficulty during the floods caused by the melting of the snow in the summer months. This stream flows into the Tashi Bhup Lake, whose southern shore is about two miles to the north of the Pundit's road. From the eastern end of the lake a stream issues, whose waters are said ultimately to drain into the Charget Lake, from which they emerge under the name of the Ná-k-chu-khá River, and flow east-

ward to the village of the same name which lies on the northern road between Lhása and Pekin. At the point where the Shyal-chu was passed by the Pundit, his road was crossed by another track going from Manasarowar to Ná-k-chu-khá, which passes south of Tashi Bhup Lake, and then follows throughout its course the stream which emerges from the east end of the lake and flows to the Charget Lake and Ná-k-chu-khá. This road is said to be perfectly easy and to abound with grass and water, but the country it passes through is uninhabited throughout.

The Pundit, who had been forewarned that the neighbourhood of the crossing of the two lines of road was a notorious place for robbers, took the precaution of pitching his camp 2 miles off the road. It is said that the custom of the Khámpa robbers who infest this country is to cut at night the ropes supporting the tent of the traveller, whom they fall upon and cut down while attempting to escape from the folds of his tent.

While under the immediate protection of the Gombo Chiring the Pundit had felt pretty safe, but he appears, not without good reason, to have passed several sleepless nights before he again reached inhabited country.

Travelling as a Láma, he had affected great poverty, and throughout the journey he kept his rupees concealed here and there in the most out-of-the-way places imaginable. His chief repository was a very old and ragged pad carried on the back of a donkey that had accompanied him from the West, and which animal, in consequence of the riches he bore, obtained amongst our travellers the *soubriquet* of *Sarkári Khizánci*, or Government Treasurer.

The Pundit reached the gold-fields at Thok Daurákpa on the 17th of September, having taken on the latter part of the journey a somewhat difficult road over hills in order to avoid the easier road to the south, which passes round the foot of the hills, but where he thought he was more likely to meet with robbers. He had now quitted the Khámpa country and had entered the Ná-k-cháng Pontod district, in which he passed two or three abandoned gold-mines before reaching Thok Daurákpa.

The Pundit only halted one day at the gold-fields, and continued his journey on the 19th of September. His route lay over precisely the same kind of country that he had previously traversed: it crossed several streams, all flowing to the north. For the first three marches the country was uninhabited; but after leaving Lhung Nakdo, numbers of Chángpa tents were almost daily seen from the line of march.

Although the plain he was now traversing was more than

16,000 feet above the level of the sea, the Pundit does not appear to have suffered very much from the great elevation; the weather was mild, and he speaks of the whole of the journey over the plains of Tibet as a delightful pleasure excursion, when compared with his experiences over the Karakorum and other passes on the road from Leh to Yarkand. The sheets of velvet turf, covered with countless herds of antelope, must, indeed, have formed a pleasant contrast after the equally elevated, but bleak and uninhabited, bare plains of Ling-zi Thang and Dipsang, in Northern Ladakh. The Pundit (who is fond of statistics) asserts that on one occasion he actually counted 2000 antelopes (*cho* and *gwa*), which resembled in appearance a regiment of soldiers, with their horns glistening in the sun like bayonets. The horns frequently found lying on the ground served him in lieu of tent-pegs.

In the Nákcháng Ponted (Northern and Southern) district, which extends for several marches east of Thok Daurákpa, there are altogether about 150 families of Nomads, all wealthy in horses, yáks, sheep, and goats. Throughout Nákcháng the sheep are very large and strong, and are almost all black—a peculiarity of this district alone, those in Western Tibet and Lhása being nearly all white. Yáks are used almost exclusively as beasts of burden, and on one occasion the Pundit met a caravan with two hundred of these animals carrying tea towards the west.

The Changpas of Nákcháng, who are also promiscuously termed *Horpas* and *Dogpas*, speak a language which differs but little from that of Lhása, and the Pundit had no difficulty in carrying on conversation with them.

In the eighth march from Thok Daurákpa, the Pundit encountered a lofty range of mountains, which was crossed by a high but easy pass, called Kilong, 18,170 feet above sea-level. This range runs southward, and culminates in some enormous peaks known by the name of Tártog Lhá, from which extends eastwards a snowy range, numerous peaks in which were fixed by the Pundit, along a length of 180 miles, up to where the range terminates in a mass of peaks called Gyákharma, which also lie to the south of and very near the Pundit's road. The highest of these Gyákharma peaks was ascertained by measurement to be 22,800 feet above sea-level, and the Pundit estimates that the highest of the Tártog peaks (which lay too far off the road for vertical measurement with a sextant) is at least 2500 feet higher than the highest of the Gyákharma group. Tártog Lhá was seen from the Chapta Pass at a distance of over 100 miles, and is believed by the Pundit to have been the highest mountain seen by him on his journey.

The highest peak of the Tártog Lhá group is called Tártog Yap (or father), while an enormous lake, which lies at the foot of its northern slope, is called Dánggrá Yum (or mother); these two, according to local tradition, are the progenitors of the whole world. The circuit round the mountain and lake combined is a common pilgrimage, not only for the people of the Hor country, but for their more distinguished co-religionists from Lhása. Similar circuits are made round the sacred mountain of Kailás, near the Manasarowar Lake.

The circuit round the lake alone occupies from eight to twelve days, the distance being about 200 miles; but the complete circuit of lake and mountain takes up nearly a month. The country people believe that if they make the complete circuit (termed locally *kora*) once, they will be absolved from ordinary sin; for a man to be cleansed from murder requires two *koras*; but if the round is completed thrice, even the murder of a father or mother will be atoned for. The Pundit did not feel much comforted on learning that this is all implicitly believed by the country people.

The district surrounding the Dánggrá Lake and another smaller lake, to the north of the road, is called Nákháng Ombo. It is surrounded on all four sides by snowy mountains, and contains several villages. Each village contains twenty or thirty houses, built of stone, and surrounded by richly-cultivated fields, which produce a profusion of barley. The harvest was not quite gathered in on the 28th of September, the date of the Pundit's arrival.

The existence of this cultivated Ombo plain enclosed by mountains, which in their turn are surrounded by boundless extents of pasture-land, is a very curious feature.

The Pundit had not seen a single field of grain of any description since leaving Chabuk Zinga, thirty-five marches to the west, nor did he again meet with cultivation until reaching Tulung village, near Lhása, thirty-nine marches beyond Ombo. The height of the plain (15,240 feet above sea-level) is not less than that of the surrounding country, and, although somewhat protected from wind, it is no better off in this respect than the district of Nákháng Gonnak, which borders it on the east, which is also well watered, and has apparently a richer soil, but is, nevertheless, totally devoid of cultivation.

The Pundit is of opinion that the Dánggrá Yum Cho and the smaller lake of Táng Jung, to the north, were formerly connected together in one vast expanse of water. The Dánggrá Lake is even now so large, and the wind sometimes raises such violent waves, that the Pundit compares it to the ocean.

Thus far on the journey, the Pundit states that a cart might be driven all the way from Noh, without any repairs being made to the road; but in crossing the range, which bounds on the east the Pembo country, the path was steep and difficult. There is an alternative road, however, lying to the north, by which it is said a cart (supposing there to be such a thing in the country) might easily travel from Thok Daurákpa to the Namcho Lake without meeting a single obstacle *en route*.

The country to the east of the Pembo district is of a precisely similar nature to what the Pundit had already passed through on the west. It is inhabited, as far as the Namcho Lake, by pastoral Changpa Nomads, who live mostly on the produce of their flocks and herds. No grain whatever is grown, but large quantities are imported from the Shigátzé and Lhása districts to the south. The inhabitants are well off, as, in addition to the produce of their flocks, they sell to the merchants of the south large quantities of salt, which is obtained from numerous *chákús*, or salt-lakes, which lie at from eight to twelve days' journey to the north of the Pundit's road.

The height of the plateau traversed appears to vary but little between 15,000 and 16,000 feet above the sea-level. The plain is, as a rule, confined between mountains which run parallel to the direction of the road, but a few transverse ridges of considerable elevation are crossed *en route*. The drainage all tends to the north, the streams from the snowy range to the south finding their way into numerous large lakes, which either lie in the *sangs* traversed by the Pundit, or are enclosed in similar *sangs* to the north. These lakes are the characteristic features of the country, and the Pundit may well be proud of the discovery and survey of such a numerous and extensive system. Of the whole series extending from Noh to Lhása, and stretching across both sheets of the map, the only one that has hitherto been known to geographers is the Nam Cho, or Tengri-Nur Lake, to the extreme east, which, although its position with regard to Lhása was approximately known, and was marked on the old Chinese maps, yet it is only within the last few years that its position and extent have been determined with anything like accuracy. This was done by another Pundit, a pupil of the veteran explorer, whose discoveries are now given to the public.

The largest of these newly-discovered lakes, the Dánggrá Yum Cho, is about 45 miles in length, by 25 in breadth, at its widest part; another large lake, the Kyáring Cho, is 40 miles in length, and from 8 to 12 across. The waters of the former are slightly brackish; but those of the Kyáring Cho, and nearly all the lakes to



the east, are beautifully fresh, and, as well as the streams which feed them from the south, contain abundance of fish, and are covered by myriads of wild-fowl.

On the occasion of the former exploration of the Namcho Lake it was frozen over, and although the Pundit made the complete circuit of the lake he was unable to discover any stream flowing from it. On the present occasion, however, our Pundit, having visited it in the autumn, before its waters were frozen, distinctly traced a stream issuing from its north-western extremity and flowing in a westerly direction. Although, at the time he saw it, the stream was not more than a few feet in width, the water-course was broad and deep, and in the summer months must give exit to a large river.

The largest river crossed by the Pundit in this section of his travels was the Dumphu, or Hotá Sangpo, which receives the drainage of the southern slopes of the Tártot-Gyákharma range of mountains, and flows into the Kyáring Cho, forming one of the numerous sources of the Ná-k-chu-khá.

The subsequent course of this last river, of which some of the head-waters have now been traced, must, I fear, remain a mystery. The account which was given by the Pundit is inconsistent with the existing ideas of the geography of the country. It is to the effect that after passing the village of Ná-k-chu-khá (Na Ptchu of the Abbé Huc), which is on the road between Lhása and the Koko-Nur Lake, the river flows in a south-east direction to Chámdo, or Tsiámdo, a well-known place on the road from Lhása to Bathang (Pá) and Pekin. Thence it is said to flow south-east and east through Ámdú to China, under the names of Máchu and Konkong. If this statement were reliable it would prove the Ná-k-chu-khá to be a branch of the famous Yang-tsze-Kiang; but, after a very careful examination of the whole of the data, Captain Trotter came to the conclusion that the evidence in its favour is not sufficiently strong to justify his entering into the subject at length.

It appears, on the whole, not improbable that the first part of the Pundit's statement may be correct, viz. that the Ná-k-chu-khá River flows to Tsiámdo; if so, it bears successively the names of La-chu, Lo-chu, and Lanthsang-Kiang, which, according to most modern authorities, is afterwards known as the Kamboja, or Mekhong River.

If, however, Klaproth's well-known map is to be relied on (but we know that in one important instance at least, viz. the identity of the great river south of Lhása with the Irawaddy, modern geographers entirely disagree with him), the Ná-k-chu-khá does

not flow to Tsiamdo, but forms the head-waters of the Nou or Lou Kiáng, which modern geographers identify with the Salween River, which empties itself into the ocean at Moulmein.

The Pundit took the same route along the northern shore of the Náncho Lake which was followed by his predecessor in 1872, and was described by Major Montgomerie in the Survey Reports for 1873-4. From the east end of the lake to Lhása the routes are identical down to the village of Dam. From Dam, Nain Singh followed the river of the same name in a south-west direction, instead of striking across the hills to the south-east, the direct route which was followed by the other Pundit.

It was not till the 12th of November that the Pundit quitted the higher table-lands of Tibet, and after crossing the Baknak Pass, 18,000 feet above sea-level, descended into the bed of the Tulung, an affluent of the river of Lhása, where for the first time for several months he found himself at the comparatively low elevation of 13,000 feet, from which a steady descent for five short marches brought him to Lhása, at an elevation of 11,910 feet. His pleasure was great on reaching Tulung Valley, where he found cultivated fields replacing pastures, and grain in abundance, vegetables, chang, and other luxuries to which he had long been a stranger. Ordinary cattle and donkeys now took the place of yáks as milk suppliers and beasts of burden. Fowls and pigs were seen for the first time since leaving Ladákh. The more civilised Bodhpas replaced the Changpas, and the Pundit was looking forward to a pleasant stay in Lhása.

But, unfortunately for him, the approach of civilisation brought him considerable anxiety. On nearing Lhása he heard a report that it was currently stated there that an English agent was on his way there from India, and that a *boná fide* Chinaman, who had recently arrived from India *viá* Nepál, had been arrested and kept in confinement until an interview with the Chinese Ambán had enabled him to prove that he was not the man they were in search of.

The Pundit, on hearing this, halted a day at Lang-dong, and sent one of his own servants (Nendak, a native of Lhása) on ahead to engage a room in a traveller's serai, and to inquire whether any news had been received of the caravan from Leh. The man returned, and reported that nothing had been heard of it; the following day (the 18th of November) the Pundit entered Lhása.

On the occasion of the Pundit's first visit to Lhása he remained there three months, and wrote a good description of the place. His present hasty visit of two days only has not added to our

existing store of information. He left it on the 20th of November, accompanied by his two servants. Prior to starting, he collected the most bulky and least valuable articles of his property, tied them up in an old blanket, carefully sealed the parcel, and handed it over to the owner of his lodging-house, whom he informed that he was going on a pilgrimage to a monastery ten days' journey to the north of Lhása, whence he expected to be back in about a month to reclaim his goods. He started accordingly in the afternoon in a northerly direction, but, as soon as evening came on, he wheeled round, and commenced his return journey to Hindústán.

The first night he halted at Kombo Thang, only 2 miles out of Lhása; the following day he reached Dhejen, a flourishing town, with a large monastery on the left bank of the Lhása River. His route for the first stage was along the high road to Peking.

From Lhása to Peking there are two roads; the one generally used, and which is believed to be open all the year round, goes at first nearly due east from Lhása to Tsiamdo, the capital of the Kham country; it then takes a southerly direction, and passes through Pá or Bathang, and the Chinese province of Sze-chuen, crossing *en route* numerous snow-covered passes across the ranges which divide the streams which rise in Tibet, and flow southwards either into the sea or into the great Kin-sha-Kiang, afterwards the Yang-tze-Kiang. From Lhása to Peking by this route is 136 caravan-marches, and the distance about 2500 miles.

The other or northern route, which is generally preferred by travellers in the hot season, is probably easier, and there is much less snow encountered *en route*. It goes by Nak-chu-khá, and crosses the head-waters of the Yang-tze-Kiang, from which there are two alternative roads to the Koko-Nur. Thence the road passes by Sining-fu (Silling) to Peking. It was followed by the Abbé Huc in his journey to Lhása.

At Dhejen the Pundit quitted the Peking road, and, turning south, crossed by the Gokhar Pass (16,620 feet) the range that separates the Lhása River from the Brahmapútra. The pass was covered with fresh snow. From it he obtained a very extensive view, embracing the Yalá Shinbo snowy peaks 60 miles to the south-east, and the Ninjen Thang Lá peaks at a still greater distance on the north-west.

On the 27th of November he reached the Sama-yé Monastery, which lies on the right bank of a small tributary of the Brahmapútra, about 2 miles before it falls into the great river.

From Sama-yé the Pundit travelled down the course of the Brahmapútra for two marches, passing several small tributaries *en*

*route.* He crossed the great river in a boat on the 30th of November. In this portion of its course it is known either as "Tsanpo" or "the river," or by the name of Tāmjun Khá. At this, now the lowest known part of the course of the Brahmapútra in Great Tibet, the Pundit estimates the width of the river at 500 yards. The stream was very sluggish, its current near the banks being no more than two-thirds of a mile per hour. Its depth was nowhere more than 20 feet.

The valley through which the river flows was here several miles across; on the left bank of the stream was a stretch of sand fully  $1\frac{1}{2}$  mile in breadth, the whole of which is said to be under water in the months of May, June, and July; during which season the river is much flooded, both on account of the increase of water from the then rapidly melting snows, as well as from the rain, which falls in considerable quantities from April to June. The river is here no longer used for irrigation, as above Shigátzé, but all the smaller streams which issue from the mountains on the north and south are thickly bordered with cultivated land.

The Pundit left the river near Chetang, from which point he states that its general course is visible due east for a distance of 30 miles, after which it encounters a range of mountains which cause it to diverge in a south-easterly direction. By taking bearings to, and fixing the position of some peaks on this side of which the river is said to flow, he fixed the course of the river approximately for a very considerable distance below where he quitted it. The course of the river thus determined is very fairly accordant with that shown on Du Halde's map of Thibet.

The Pundit has thus been able to throw a little more light on the lower course of the Tsanpo, or the Great River of Tibet. It is unnecessary to follow Wilcox, Mongomerie, and others, who appear to have clearly proved that the Tsanpo must be the large river which, under the name of Dihong, enters Assam near Sudiya, where it is joined by the Brahma-kúnd. We may safely admit that this is the case; and although the name Brahmapútra is doubtless derived from the Brahma-kúnd of the Assam Valley, geographers have, in consideration of the wide-known celebrity of the name Brahmapútra, bestowed it on the Tsanpo, the upper and most important source of the great river.

From Chetang the Pundit's road lay up the Yálung, through a rich and fertile valley, which contains numerous villages and monasteries scattered about on both sides of the stream. The country is very productive, and contains numerous fruit-trees, principally apricots and pears; wheat and barley are abundant, as well as peas, and many other kinds of vegetables. There is good

grazing on the mountains which border the valley, but the breed of sheep is very small.

From Chetang to the Dálátang plain at the head of the valley is 36 miles. In addition to numerous scattered villages of 10 or 12 houses each the large towns of Naitong and Chukyá Bhutáng are passed *en route*. From the Dálátang Lá to the Karkang Lá the road traverses for 15 miles a grassy plateau, between 15,000 and 16,000 feet above sea-level, through which flows a stream which takes its rise in springs, and ultimately finds its way into the Brahmapútra below Chetang. On this elevated region, which extends from a considerable distance to the west, the Pundit again found himself among the Dogpas, or Nomad population. It is by the Karkang Pass to the south of the plain that the main Himalayan watershed is crossed. On reaching it the Pundit states that a magnificent view presented itself. The whole of the foreground was occupied by gently undulating grassy plains, over which on the north-west, at a distance of but a few miles, rise the very conspicuous group of snowy peaks called Yála Shimba. Other snowy peaks beyond the Brahmapútra appeared topping the plateau to the north, while east and west and south, snowy peaks rose in every direction, but at great distances off.

From the watershed, which is 16,210 feet above sea-level, the road to the Kyá Kyá Lá, a pass about seventy miles further south, traverses a high undulating plateau, which is bounded on its west by a well-marked snowy ridge, which runs nearly due north and south, and contains numerous glaciers. The drainage of this country is most irregular. The Pundit's road for the first 20 miles from the pass followed a stream which, under the name of Sikung Sáugpo, flows for 40 miles nearly due east, through the Chahuil country, and ultimately turning south-east, runs nearly parallel to the upper course of the Brahmapútra, which river it is said to join in Assam. After leaving the main stream, the road ascends a branch valley for a distance of 20 miles to the Serása Pass (15,300 feet), and thence descends into a stream which flows due south for 40 miles, and subsequently, under the name of Táwáng-chu, takes a westerly course, and flows round the southern extremity of the southern range which has been mentioned as bounding the plateau on the west.

That portion of the plateau which contains the head-waters of the Sikung River is from 13,000 to 15,000 feet above sea-level. It is a very flourishing, well-cultivated country, covered with numerous small villages containing settled inhabitants.

The road itself, after leaving the Serása Lá, goes nearly due

south, crossing in succession several spurs from the western range, and after reaching the Kyá Kyá Pass, rapidly descends into the Chukhang Valley, which is separated from that of the Táwáng by a very high ridge which is crossed by the Mila Khatong, a pass which was covered with fresh snow.

Between the Sikung district and Chona Jung the country is uninhabited.

Chona Jung is a place of considerable importance, and is a great exchange-mart where salt, wool, and borax from the Hor country, and tea, fine silks, woollen cloths, leathern boots, and ponies from Lhása, are exchanged for rice, spices, dyes, fruits, and coarse cloths from Assam. This market must be one of considerable importance, and contains 300 or 400 shops. The Pundit is of opinion that although the import and export trade is not nearly so valuable as that at Leh (the great exchange mart for India and Eastern Turkistán), yet that the number of traders and animals and men employed in carrying loads is somewhat larger. The merchants who import the articles from Assam are mostly natives of Táwáng, who are called Monhpas; but the goods imported from Hor are brought in by the Dogpas or Changpas. The goods from Lhása are brought by merchants from that place. The road from Chona Jung to Táwáng Chukhang is closed by snow from January to May or June.

The Pundit reached Táwáng on the 24th of December, and was detained there till the 17th of February, having been unable to get permission to proceed to the south.

Leaving Táwáng on the 17th of February, the Pundit reached Odálguri, in British territory, on the 1st of March, the road being often deep in snow, while four passes had to be crossed *en route*; of these the passage of the Sai Lá and the Menda Lá were somewhat difficult on account of snow.

At Odálguri the Pundit put himself in communication with the Assistant-Commissioner of the Darrang District, who kindly made all the necessary arrangements for forwarding him to Gauháti, whence he went by steamer to Calcutta, which place he reached on the 11th of March, 1875.

Before closing this Paper it may be well to recapitulate the chief results of the Pundit's last exploration.

He has made a very careful and well-executed route-survey of the whole line of country traversed. viz. 1013 miles from Lukong (west end of Pankong Lake) to Lhása, and 306 miles from Lhása to Odálguri. Of this total distance of 1319 miles, throughout which his paces and bearings were carefully recorded, about 1200 miles lie through country which has never previously been

explored. Numerous lakes, some of enormous size, and some rivers have been discovered; the existence of a vast snowy range, lying parallel to and north of the Brahmapútra River, has been clearly demonstrated, and the positions of several of its peaks have been laid down, and their heights approximately determined.

The Brahmapútra has been followed for a distance of 30 miles in a portion of its course, 50 miles lower down than the lowest point hitherto determined; and as its approximate course for another 100 miles has been laid down, the absolutely unknown portion of that mighty river's course now remaining has been very materially reduced. The route between Lhása and Assam, *via* Táwáng, of which next to nothing has hitherto been known, has been carefully surveyed, and the daily marches described.

As a framework for the map, no less than 276 double altitudes of the sun and stars have been observed with a sextant for the determination of latitude, and the close accordance of the results *inter se* and with the mapping of the route, by the pacings and bearings, prove incontestably the general accuracy of the work.

The temperature of boiling water has been observed on nearly every pass and nearly every camping-ground (497 observations in all), adding materially to the value of the maps.

Frequent observations of the temperature of the air and the direction of the wind have given us some further addition to the knowledge of the Tibetan climate.

The Pundit suffered much in health during the latter portion of the journey, and his eyesight has become seriously injured from exposure and hard work, in most trying climates, throughout a long series of years. He is now anxious to retire from active work, and will probably receive a grant of land in his native country; and thus, having happily survived the perils and dangers of the road, it is hoped he may spend the declining years of his life in comfort, and with a due appreciation of the liberality of the British Government.

[The above Paper will be printed entire in the 'Journal,' vol. xlvii.]

The PRESIDENT was sure all present must have felt that the journeys of Nain Singh were of the greatest interest. He had filled up a great blank in the map of Thibet, and had discovered numerous lakes and rivers which were formerly unknown. His last journey was of special interest at the present time, because the English Minister at Pekin, in his recent convention with China, had stipulated that there should be a right of travel from China across Thibet into India, opening up the very route which Nain Singh had traversed. Every part of Central Asia was becoming daily of more interest, politically, and even commercially. Such journeys as that which the Pundit had accomplished, however, were full of peril and wasteful of human life, and

therefore the Pundit was entitled to great praise. He had undertaken two journeys each extending over 1200 miles. The last was across the great northern plateau of Thibet. By far the most interesting account of any journey previously made in the present generation in that country, was that written by the Abbé Huc, and his brother missionary, the Abbé Gabet. The Abbé Gabet died very soon after his return home; and though Abbé Huc lived to write a brilliant book, and was very much fêted and appreciated in his own country, France, he died a very few years after. There was no doubt that the health and constitution of both were ruined by the trials which they experienced in traversing the Thibetan plateau from 15,000 feet to 16,000 feet above the level of the sea. The Society were much indebted to Captain Trotter for giving them an account of the journeys of the native explorers beyond the Himalayas.

Colonel H. YULE said, although he had not himself been in Thibet, in that respect he was in a similar position to every one present. Some few Europeans might have got, as it were, upon the margin of the region, but in the course of many centuries very few had actually entered on the great plateau. If only the journey of the Pundit from Ladak to Lhása, which had just been described, was considered, it might seem that the results were not of the highest importance; but the labours of Nain Singh must be taken as a whole. This was not his first journey. In 1865-6 he made another and a more important journey of about the same length, when he visited Lhása, and traced nearly the whole course of the great river which was generally identified with the Brahmapútra. Thibet was a most interesting country in many respects. If the sea were supposed to rise until it attained some 13,000 feet above its present level, nearly the whole of Asia would disappear, and so would Arabia, Persia, India, and China, leaving the large tract which was called Thibet. That would remain above the surface. There was no other such extensive area in the world of such an elevation. A region extending over 300,000 or 400,000 square miles might be found in Thibet never descending below the level of the top of Mont Blanc. That was one remarkable circumstance about Thibet. Thibet must really be considered to begin immediately north of Cashmere, and to extend to the Chinese frontier at Sining-fu. Over all that country substantially the same language was spoken, and, with one exception, it was of one religion, that of Lama Buddhism. The only exception was to the extreme west, where in the country which was known as Little Thibet the people had for some centuries been Mahometans. The accurate geography of this country might be said to have begun in the year 1710 or 1712, when the Jesuit Missionaries were engaged in making their great survey of China. They were not themselves able to enter Thibet, but they partially trained some Lamas, very much as Colonel Montgomerie had trained the Pundit, and these Lamas made a kind of survey, giving in a general way the course of a good many rivers, which were afterwards mapped by d'Anville in his great atlas of China. Until lately that had been the foundation for our knowledge of Thibet. It was not, however, known what value to attach to a good many of their points, and a great deal of their description was obviously very vague and general. The Pundit Nain Singh was the first who had given accuracy and substance to the map of Thibet. He had fixed the position of Lhása, and of the great river, and carried a diagonal from Ladak to Lhása. Though Thibet had been entered at various times by European travellers, unfortunately none of them were geographers or surveyors. About the year 1660 or 1670, two Jesuit priests, Grueber and d'Orville, travelled from Sining to Lhassa, then to Kathmandu, and into India; but the account of their journey was very meagre, and they took no observations. Afterwards an Italian priest, Ipolito Desideri, entered Cashmere and travelled from Ladak to Lhása—possibly by the very route which the Pundit had described, but his journal



had only recently been recovered in Italy, and had not yet been published. In the last century a Dutchman, Vanderput, travelled from India through Lhâsa to China, and back again the same way, but had left hardly any record of his journey, and that little would have been totally unknown but for the exertions of Mr. Markham when compiling his book on Thibet. The next journey was by Bogle to the north of the Tsanpo; and 40 years later, Mr. Manning reached Thibet. Why he went there it was difficult to understand, even from his own journal; but he did get there, and was arrested, and sent back again. The next account was that of Huc and Gabet. They also were not geographers, and they added almost nothing to the geographical knowledge of the regions, though the book which the Abbé Huc published was one of the most entertaining that ever was written. It therefore remained for the Pundit Nain Singh to give an accurate basis for the maps of Thibet. That was the great achievement which he had accomplished with very much toil, and with the sacrifice of his own health, and which was the great reason why the Geographical Society had awarded him their Gold Medal.

Sir HENRY RAWLINSON said he was particularly glad to attend on the present occasion, because, independently of the interest which in common with all geographers he took in the discovery of previously unknown tracks of Central Asia, he had a personal interest in the Pundit's journeys. Ten years ago, when Colonel Montgomerie brought the first journey of the Pundit before the notice of the Society, he was the means of obtaining from the Council of the Geographical Society the presentation of a gold watch to the Pundit in recognition of his valuable services to the cause of Geography. He had therefore always felt that he was to a certain degree sponsor for the Pundit in his geographical work. On referring to the 'Proceedings' of the Geographical Society of that date, he was particularly struck by a remark of the late President, Sir Roderick Murchison, who, with that wonderful prescience which distinguished him on so many occasions, in presenting the gold watch to the Pundit, said that he felt pretty sure that that was only an earnest of further distinction, in fact, he unmistakably alluded to the probable presentation to the Pundit of the Gold Medal of the Society on some future occasion. From that time to the present he had always followed the Pundit's work with deep and ever-increasing interest, and he was delighted to find that his career had now culminated in his carrying off the Blue Ribbon of Geographical science—the Gold Medal of the Royal Geographical Society. But while he gave every possible credit to the Pundit for his perseverance, his gallantry, and his skill, he could not forget the claims to consideration of the Department of the public service which founded the school to which the Pundit belonged. It was found to be a crying want in the geographical researches of India that Europeans were unable to penetrate into those countries which lay on the north and north-western frontier, and it occurred to the heads of the Department of the Trigonometrical Survey that it would be desirable to found a school for the purpose of promoting discovery by native agents. It was a very difficult task to commence with, but by degrees the Department succeeded in training both Mahometans and Hindoos for the purpose of exploration; and he had always felt that great credit was due to those officers, especially to Colonel Walker, the head of the Trigonometrical Survey; Colonel Montgomerie, who really founded the school of native explorers; and Captain Trotter, who not only completed the work of his predecessors, but also utilised the results which they had obtained. Such men as the Pundit, the Havildar, and the Mirza, were invaluable in traversing unknown countries, where Europeans were unable to show their faces. They collected facts, recorded distances, and made observations for altitude and latitude. None of them had, however, as yet been able to determine a longitude. The taking of a lunar appeared to be beyond the power of any native surveyor. The longitudes had been arrived

at by cross routes and dead reckonings, so that the position of Lhása had not yet been scientifically ascertained. The latitude was determined by the Pundit on his former visit in 1865, when he spent three months there. Great credit was due to the officers who had sent out these native explorers, and on their return had tabulated their observations and memoranda. He regretted the absence of Captain Trotter, who no doubt would have been most gratified to hear Colonel Yule's well-deserved eulogium on the Pundit's work, and the few words which he himself (Sir Henry Rawlinson) had expressed as to the services performed by the Trigonometrical Survey.

The PRESIDENT said he had hoped that Sir Douglas Forsyth would have been able to attend that evening, but a letter had been received from that gentleman stating that he was suffering from a serious cold, and could not be present. He had, however, written a few observations, pointing out that Nain Singh had been one of his own employés, and was engaged in carrying out a system of exploration which Captain Trotter designed.

“14th May, 1877.

“Though unfortunately I am unable to attend this Evening's Meeting of the Royal Geographical Society, I shall be glad to be allowed to convey through you some remarks on the labours of the distinguished Pundit, Nain Singh, an account of whose latest travels, I understand, is to be read instead of the Paper promised by Captain Trotter.

“A very interesting summary of the Pundit's proceedings was given in the ‘Times’ not long ago, from a perusal of which, the claims of this remarkable Indian surveyor to the high honour which has just been conferred on him by the Royal Geographical Society are made abundantly evident. Yet even in that statement the facts are in one instance only inadequately represented, and there is a not unimportant omission which I would in a few words supply.

“I allude to that part of the statement which says that the Pundit was attached to the Mission to Kashgar in 1873, but returned the same year, and no mention is made of the services rendered to that mission, either by himself or his brother Pundits, nor are the facts attendant on, or rather leading to, his undertaking the final journey which has proved the crowning point of his labours alluded to.

“The facts are as follows. When the Government of India decided to send a diplomatic mission to the Atalik Ghazee in 1873, it was determined to appoint an officer of the Indian Survey Department to accompany the Expedition as Geographer, and to give him an efficient staff of Assistants. Captain Trotter was the officer selected; and Abdul Subhan, a sub-surveyor in the Topographical Survey Department, and two of the great Trigonometrical Survey Pundits with their Assistants, were added; and so far from Pundit Nain Singh having returned the same year without doing anything, he remained with the Mission the whole time, and was despatched on his Lhása trip by Captain Trotter, after our return to Ladak in 1874.

“Of the invaluable service to science rendered by Captain Trotter, it is not necessary now to speak, as I hope some other opportunity may be afforded him of proving his claims on this Society. But as the Paper which has been read this evening, giving a record of Pundit Nain Singh's travels, was drawn up by Captain Trotter, and as the Pundit was deeply indebted to his English superior, at almost every step, for advice and instruction, it is only fair to Captain Trotter that those of us who had opportunities of observing his powers of organising the staff placed at his disposal should bear testimony to the evidence of good generalship thus displayed.

“The original plan for utilising these Assistants was to send the Mahomedan portion into the countries across the Pamir and the Alai—wherever, in fact, they would meet their co-religionists—and to send the Pundits by the northern

route to Lake Lop, and thence to despatch them across the great Gobi Desert, through Thibet and Lhása to Hindostan. These plans had to be abandoned, and a less ambitious programme was carried out, in which Pundit Kishun Singh proved himself to be a worthy follower of the one whom we now delight to honour. I will tell immediately what Kishun Singh did, but will first dispose of Pundit Nain Singh. He remained during the severe part of the winter in Yarkund, and took valuable meteorological observations. As soon as the season for crossing the Pamir came round, Pundit Nain Singh was despatched from Yarkund to explore the Kozgar route to the Karakorum, and the report he sent back proving very favourable, we all returned to India by it.

"Pundit Kishun Singh's explorations were of a more extended character. Besides accompanying Captain Trotter in his expedition from Kashgar, he was taken by that officer on his Pamir Expedition, as far as Tash Kurgan, and despatched thence to Yarkund by the direct route, viz, the Chailing River. He then was sent by Khoten and Polu, across the eastern continuation of the Kuen Luen, and over the vast lofty plain to Lake Pangong and Leh. The survey of this route was pronounced by Captain Trotter to be one of the most important geographical results secured by the Mission. After detailing the Pundit's progress, Captain Trotter says, 'The newly acquired knowledge of this road may, perhaps, lead to important practical results. . . It is apparent, by combining the results of this survey with other information collected by the Survey Pundit during the past few years, that a road exists between the plains of Hindustan and Turkestan, which entirely avoids the territories of the Maharaja of Kashmir, and which in summer months may be traversed without once crossing snow, or without encountering one really difficult pass, such as are known to exist in the Kara Korum and Changchemno routes.' One result of Pundit Kishun Singh's route-survey was to cause an alteration of more than 30 miles in the previously accepted value of the longitude of Khotan.

"The success achieved by Kishun Singh in this journey across the range from Khoten to Leh, suggested, or at all events stimulated, the idea of sending Nain Singh on his long cherished journey of exploration through Thibet, and across the eastern end of the Himalayas to India, a trip which he has bravely accomplished.—T. DOUGLAS FORSYTH."

Mr. E. DELMAR MORGAN remarked, that although the Pundit's journey was no doubt a very interesting one in many ways, it was desirable that some European should visit the same regions, who would be able to collect facts relating to the animal and vegetable life there. Sir Henry Rawlinson had spoken of the difficulties to be overcome in such a journey, but when it was remembered what English explorers had done in the Himalayas, and what Russian explorers had done further to the north, among mountains as high and passes as difficult as those which the Pundit had visited, surely men could be found to explore the great plateau of Thibet. Colonel Yule had omitted to mention one explorer who had done good service in the northern part of Thibet, the Russian traveller Prejevalski.

Mr. TRELAWNEY SAUNDERS said, no one who had studied Himalayan geography could fail to feel grateful for the two vertical sections across the mountains down to the Tsampo, by Pundit Nain Singh, one of which was described in the Paper. Those sections had thrown a general light on the whole subject. He was highly delighted to hear that the Society has awarded its medal to the Pundit. Nothing could be more encouraging to our fellow-subjects of low rank in India than such an appreciation of merit. He looked upon Thibet and its great flocks of sheep as a source of wealth, not only to that country, but to India and England, and a substitute for cotton, whenever the Americans themselves manufactured that cotton which now supplied the English looms. One point that the Pundit had settled beyond

dispute was that of the distinction between Hor Pa, or High Land, and the Sok Pa. These were the two great ethnological divisions of the country; the Hor Pa being occupied by tribes of Turkish race, and the Sok Pa by Mongols, whose Sok or pastures gave them their name, and pointed to the origin of the ancient Scythians. While the region inhabited by the former was a high mountainous plateau drained by interior lakes, that occupied by the Sok Pa was intersected by the deep ravines of the affluents of the Biabmaputra, the Salween, the Cambodia, the Yang-tsze-Kiang, and the head-waters of the Hoang-ho. He was particularly delighted to hear that all this magnificent region was probably no longer to be hermetically sealed to European observation. Allusion was made in the Paper to Kalka, which had long been regarded as an inexplicable puzzle, and he hoped that when the Paper was printed in the 'Journal' it would be accompanied by an explanatory note on the subject of Kalka. Mr. Markham had elsewhere, and so had he himself, explained the problem. Karka was noticed by Turner. It was identical with Kalka, which was derived from the Kalka River of Northern Mongolia. That river gave its name to the Mongolian princes, who, when driven out of China, previous to the Manchu invasion, settled on the Kalka River, and so acquired the name of the Kalkas. Outer Mongolia is divided among the four Kalka Khanates to this day. The high priest or Taranath Lama of the Kalkas governed the priestly influence that controlled all Mongolia. Such was the importance attached to this high priest, that the Chinese Emperor found it necessary to take his election out of the hands of the Kalka princes and make it subordinate to the Grand Lama at Thibet. The Russians supported an armed mission at Urga, the seat of the Taranath Lama; and he hoped that we might look forward to some peaceful intercourse with Lhása, at no distant period.

Sir HENRY RAWLINSON said intelligence had recently been received that Colonel Prejevalski had reached Lob Nor, the lake in the great plain of Tartary, which had never before been visited by an educated European. He had travelled round it, and found that it was of greater extent than had previously been supposed. He had also discovered traces of several ruined cities on the southern and south-western shores, recalling those traditions of buried cities which Sir Douglas Forsyth had collected. Mr. Morgan asked why English officers were not able to perform journeys into Thibet. The physical difficulties of course could be overcome, but the exclusive policy of the Chinese had hitherto prevented any Englishmen from surveying the country. If the Chefoo convention was carried out, as it was hoped it would be, then no doubt there would be a little army of scientific explorers sent into Thibet, who would collect specimens of the fauna and flora, and exhaust the scientific examination of the country. The same political difficulties existed in some Mohammedan countries. No European had been allowed to trace the upper course of the Oxus, or the great route by the Chitral Valley from Peshawur.

The PRESIDENT said Lhása was the Mecca of the Buddhist world of Eastern Asia, and it was no more possible for a European to get to Lhása than to Mecca. It was true that Captain Burton had succeeded in reaching the latter city; but when Mehemet Ali once was asked by a well-known traveller for authority and an escort to go to Mecca, the reply was: "Yes, you can go to Mecca and you can have an escort; but you won't come back, you know, and I don't think many of your escort will return either." Geographers are indebted to Sir Thomas Wade, who has obtained the recognition of our rights as to travelling through this country under the "Favoured Nation" clause. No doubt it would be a long time before the advantage would be much utilised, for it was a very natural thing for the Chinese, whose power over the country was really dependent on the influence of the Lama at Lhása, to look with the greatest possible jealousy and suspicion upon the entrance of Europeans,

who might shake their authority there. A debt of gratitude was due to the Pundit, who had been exposed to great perils. When in Lhása he was recognised by some one who knew him, and it was only a question of time as to when he would be betrayed; and, in all probability, if he had been, no more would ever have been heard of him. However, when he was convinced that he was recognised, he gave his journals and observations to two of his attendants, and despatched them off to India, while he went forward for two days, in order to blind the authorities, and give his attendants a good start. That was a piece of true heroism. It was not that Englishmen were not capable of encountering the physical difficulties and dangers of such a route, but the political and religious element was sure to bar the way. In awarding Nain Singh the Gold Medal, the Council wished to show to the world that in bestowing their highest honour, they were not influenced by considerations of race, or creed, or nationality, but gave it to the men who had done the greatest service to Geographical Science.

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## ADDITIONAL NOTICE.

(Printed by order of Council.)

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*Voyage of the 'Ellangoran' to China Straits, New Guinea.* By  
Rev. S. MACFARLANE.

WE left Somerset on the 21st of March, having on board our newly-arrived medical missionary, Dr. Turner, and his wife; also the teachers' wives from Yule Island, who had come over to recruit their health, and had sufficiently accomplished the object to enable them to return to their husbands and work.

We anchored for the first night at the lee-end of a reef near Village Island, and, although rocked all night, got very little sleep. Next day it was too rough to call at York Island—our wooding-station—so we ran on to Darnley. Here we found the teachers suffering from fever and ague, as well as the natives themselves, but nothing serious.

We started from Darnley on the morning of the 24th, and sighted Anchor Quay about noon. Crossing the Gulf we had a light head-wind; still we hoped to reach Yule Island by the evening of the following day. The sun set, and darkness came on, however, before we reached the passage, and a heavy squall came off the land, rendering it impossible for us to see our way. Having run what we supposed to be our distance, we anchored in 15 fathoms of water, and in the morning were pleased to find ourselves near the mouth of the pass.

It was a lovely Sabbath-morning when we steamed into Hall Sound. The wind and rain had ceased. The sun rose behind Mount Owen Stanley, dispersing the thick banks of clouds and lighting up the hills. The scene was grand. The mountain-ridges rose tier on tier, like mighty fortifications, piled up to the heavens, and patches of fleecy, snowy-white clouds lay on the hill-sides, as if the artillery from these gigantic batteries had been recently at work. Mounts Yule and Owen Stanley sat in solemn grandeur in the midst of this majestic scene like Nature's generals, with their bare heads in the clear atmosphere, and a cloudy plaid drawn around their shoulders. The rising sun and morning clouds made it quite a panoramic view, upon which we gazed long after we came to anchor.

The teachers Waunaea and Anederu came off in their boat, accompanied by Dr. James, formerly attached to the Macleay Expedition, who is collecting specimens of natural history in the vicinity of Yule Island. They had all been suffering from fever, indeed they had an attack the day before we arrived, but find Yule Island, on the whole, as healthy as most of the islands in Torres Straits. We went with them on shore, and found that the teachers had nearly completed their new house, which is neatly built on a cliff, situated on the weather side of the island about 2 miles from the anchorage. It is a two-story house, the frame of which is well put together, and covered in with pandanus-leaves neatly sewn together. The doors and shutters are made from the sides of old canoes.

The teachers appear to be making a favourable impression upon the people especially upon the young folks, who like to go with the teachers in their boat visiting, and who make a very good crew. The women seemed pleased to see the teachers' wives back again, and asked if Mrs. Turner was a woman! When they were assured that she was, the news passed from one to another, and all pressed forward to have a look. Mrs. Turner made the chief's wife a small present, who returned some time afterwards with two dishes of cooked food, which he presented to her. At the teachers' house we got the principal men together, to whom I addressed a few words through the teacher, explaining to them our object in coming amongst them. Having made them a small present, we left, returning by land across the island, which appears to be pretty well watered. After visiting several parts, we selected what seems to be the best site for a mission-station, notwithstanding the mangrove-swamp close by. It is a tolerably healthy plateau, about 200 feet above the level of the sea, exposed to both south-east and north-west winds, near a running stream of good water, and also near the bay, where there is a fine sandy beach, and one of the best anchorages on the coast of New Guinea.

A sad accident occurred whilst we were at Yule Island; Captain Redlich, of Torres Straits, had gone over in his cutter to see about some natives who had formerly been in his employ. He was anchored near the *Ellangowan*. Seeing a shoal of fish close by, and being accustomed to catch them with dynamite, he pulled off in his dingy with a native, lighted the charge of dynamite, and was in the act of throwing it, when it exploded, carrying away his left hand. The native pulled quickly to the *Ellangowan*, where he was taken on board by Captain Runcie. We had just arrived on the beach from our trip inland, when we heard the report of the dynamite and the shriek from Captain Redlich. We hastened on board, where we were met by the horrible sight of the shattered stump. We immediately sent for Dr. James, but as it would be about an hour before he could arrive, Dr. Turner commenced the operation at once, cutting away the shreds and bone at the wrist-joint, and had finished some time before Dr. James arrived. We took Captain Redlich with us to Port Moresby at his request, his crew following in the cutter, and there Dr. Turner attended him, whilst Mr. Lawes and I went to China Straits.

We found that Port Moresby had put on its best appearance. The recent rains had made the hills look fresh and green, many of which are now under cultivation. Several large canoes with cargoes of sago had just arrived from the Gulf, which enlivened the scene, the crews being busy, driving a brisk and noisy trade with the people of Port Moresby. It looked as if such a place must be healthy; but when we see every member of the mission, down to Mrs. Lawes' baby, suffering from fever, and count the number of teachers' graves, we are driven to a different conclusion.

I visited and examined one of the large canoes. Although rudely constructed, they are evidently the result of immense labour. It consisted of five logs about 40 feet long, hollowed out and lashed together. The outside ones were about 4 feet in diameter, the three inner ones being only half the

size. It must take a long time and great labour to fell and cut out these large trees, with nothing but stone implements and fire. Having prepared the logs and burnt holes along the upper edges, they are placed alongside each other, about 6 inches apart; strong poles are cut and laid across the canoes to which they are lashed; so that when the vessel is "high and dry" it rests upon the two outer canoes, the three inner ones being suspended from the poles, to which all are tied with ratan. Thus their trading-vessels have really two keels; one on each side, instead of one keel in the middle like ours. The cross-poles are allowed to project about 4 feet over the canoe on each side, and are covered with small sticks, forming a balcony. Whilst level with the side of the outer canoes, a fence is erected, about 3 feet high, which is enclosed with the leaves of the sago-palm. The platform projects about 6 feet over the ends of the canoe. Each end of the enclosure is roofed in like a native house, and in these compartments men, women, and children, live during their voyages, much as they do when on shore. Some have only one, and others two masts, which are simply forked trees taken up by the roots, by which they are lashed to one side of the platform at an equal distance from each end of the canoe, and secured by two ratan straps fastened to the opposite side of the canoe at each end. The large mat-sail is a remarkable-looking object. It is like a boy's kite of immense size, except that the top is concave instead of convex, the two sides curving in a little, making the top of the sail the same shape as the moon appears when a few days old. The sail is hoisted by a rope fastened to the *side* of the sail at the widest part, and thrown over the fork of the mast. The other side of the sail has two ropes fastened to it, so that it can be hauled either way. In tacking, they simply move the rudder from one end of the canoe to the other.

Mr. Lawes joined us at Port Moresby, where Dr. and Mrs. Turner remained until our return. Having on a previous voyage visited the villages from Port Moresby to the western side of Hood Bay, we decided to commence with *Kerepunu*, which is situated on the eastern side of the bay, at the entrance to Hood Lagoon. We left Port Moresby on the afternoon of the 3rd of April, and steamed through the Basilisk Passage, hoping to run down under sail during the night, and so save our fuel; but the wind fell off, obliging us to keep up easy steam. On the following morning we stood in for Hood Bay, running along the reef on the eastern side. This reef, it appears, is fine fishing-ground. We saw about a hundred natives at work there. Being anxious to get as near the village as possible, we steamed slowly along the reef, hoping to find some passage through which we might push our little steamer; but there did not appear to be any opening. We returned to try and find anchorage under the lee of the barrier-reef; but could not find a bottom at 25 fathoms. Evening had set in, and we felt that we must anchor in the bay somewhere for the night; so we returned towards the head of the bay, and, when well up, saw, to our delight, a fine passage behind the reefs, large enough for a vessel of a thousand tons. We steamed up to the lagoon, and anchored in the entrance close to the village, which is a quiet and safe anchorage at all seasons.

It very soon became evident that we had dropped into a thickly-populated place. Canoes came off thick and fast; but there was no cause for alarm, as the people are friendly with those at Port Moresby, and some of the chiefs had met Mr. Lawes there. Our decks were soon crowded with men, women, and children, all talking at once, as loud and as fast as they could. They are a fine, healthy, strong, and active people; seemed mightily pleased with all they saw, and especially with what they got on board. They urged us to go and see their villages on the morrow, and went on shore to have a big dance, and dream of beads and hoop-iron. We heard the drums and singing nearly the whole of the night.

At an early hour in the morning the nine chiefs came off with a crowd of people. In order to secure a little space for breakfast, which we generally have on the skylight, we fastened a rope across the deck. It was highly amusing to see the dusky crowd pushing and fighting for good places to see the lions feeding! They seemed astonished at the "set out" on the table, and I daresay some of our friends at home would have been astonished too, though from a different point of view! They were evidently in doubt about the salt beef, and asked if it was human flesh. We gave them a piece of bread, which they examined and smelt, and passed from one to the other, also a little sugar; but no one had the courage to taste, although what the taste would have been in their dirty mouths, filthy with constantly chewing the betel-nut, chinam, and a kind of astringent bark, it is hard to say. At prayers they seemed bewildered, although they had evidently an idea that they ought to be quiet. We had some talk with the chiefs, some of whom could speak the Port Moresby language. Having made them a small present each, we accompanied them on shore, and were delighted to find on every side evidences of intelligence, industry, and cleanliness. We were conducted by the chiefs, and followed by a crowd of people through the township; which consists of nine villages, connected by lanes and gardens neatly fenced in; the former, like the villages, cleanly swept, and the latter well weeded. Although the houses and streets are overshadowed by trees, not a dead leaf or cocoanut-husk is to be seen. They must be swept at least once a day. Parrots and cockatoos are great pets, and are to be seen on the verandahs of many of the houses. One part of the people devote themselves to fishing, and the other to planting, neither interfering with the special work of the other, but each returning in the evening from fishing and planting to barter their provisions. The agriculturists never try to catch fish, nor the fishermen to plant, although they live together. A large plot of land is turned over very systematically and quickly by a number of men standing in a row, with a pointed stick in each hand, which they raise and plunge into the ground simultaneously, and then use them as so many levers to turn over the soil. It is surprising how quickly they can turn over an acre of soil in this way. They make and use a great number of canoes; some have outriggers, though they are mostly double, two lashed together about 18 inches apart. We saw them at work making a number of canoes, and were surprised at the adaptability and durability of the stone-axes, and their dexterity in using them. They cut very much better than some of the common axes sold to the natives by Europeans. The houses of the Kerepunuites are well built, their canoes neatly made, their gardens carefully cultivated, their streets kept clean; everything, indeed, appears to be done decently and in order. They understand well how to drive a bargain, and may be considered a commercial people in a much higher state of civilisation than many of their neighbours. The chiefs seemed delighted to walk with us arm-in-arm through the town, carrying our umbrellas. I noticed that walking arm-in-arm was quite common amongst them, especially among the young people. On the deck of the vessel, as well as in the streets and villages, the young women seem to hang on to the arms of the young men quite naturally. We suppose the town to consist of not less than two thousand inhabitants.

From the natives we learnt that a river runs into the lagoon which takes its rise behind the Astrolabe range, so we took our small boat and crossed the lagoon, which is about 15 miles in circumference, and from 5 to 9 fathoms deep at the entrance, and for more than half-way across; although it has hitherto been supposed that there was no passage into it, now, however, we have found it to be a splendid anchorage, large enough to accommodate a fleet. The river bears about N.E. from the entrance of the lagoon. We pulled up it for 1½ mile, found it 8 feet deep, and about 80 yards wide,



although shallow at the entrance, there not being (the way we went) more than 2 feet of water at low tide. At first it bore to the east, and then took a pretty sharp turn round a range of hills and bore to the north-west, running, the natives say, between the Macgillivray and Astrolabe ranges. From the account of the natives, it would appear that the Astrolabe range is the watershed or source of this river and the Manumau, the one running to the east and the other to the west. We have named our discovery the *Dundee*. It runs into a basin, about a mile in circumference, just before entering the lagoon.

On our return to the vessel, we found that some one had stolen a piece of rope during our absence, and that the chiefs were very angry about it, fearing we should (as they expressed it) consider them thieves, like the Port Moresby people. They immediately went on shore, and returned with the father of the boy who had stolen the rope, and who was willing to bear the punishment, and the chiefs seemed to think that he ought to receive it, if not for the rope, at least for their trouble in bringing him to the ship.

When we left Kerepunu, on the morning of the 6th of April, we were surrounded by canoes. The moment the natives found the steamer moving there was a general rush to the ship's side and a scrambling for canoes; some jumped into the sea at once; others made a leap for canoes, which they just missed; whilst others crowded into a small canoe, which quietly took a tack downwards, and so got rid of the lot. The scolding and shouting and laughing was amusing and deafening. They seemed astonished and bewildered at the vessel moving away without sails or oars. Soon after we started the breeze freshened, so we set our square sail and stopped the engine. In the afternoon we came to anchor under the lee of Constance Island, a small island just inside the barrier reef, with a beautiful sandy beach all round, thickly wooded, and the home of hundreds of pigeons. This is a good and convenient anchorage for vessels running along the coast if in want of a safe place for the night, where they may easily get a good supply of pigeons for all hands. It will be a good wooding station for our little steamer. It is about a mile in circumference and 7 miles from the mainland. We saw a large canoe at anchor on the reef about 2 miles off, and soon after we landed five small ones approached us from the reef. We went towards the place where they seemed disposed to land, but they evidently did not desire any intercourse with us, and pulled away, waving us off. Returning to the place where we landed, we went round the island the other way, to meet the fishing-party from the canoes, who evidently intended camping there for the night. We came upon them with their canoes hauled up, so that they could not get away before our arrival. They still waved us back, but we continued quietly walking forward, making friendly signs. They were busy preparing the fish they had caught for preserving to be taken to their homes on the mainland. Their language bears some resemblance to that spoken at Port Moresby, although the similarity appears to be very slight. They were delighted to get the feathers of the pigeons which our natives had shot, explaining to us, in a most graphic and unmistakable way, that they wanted them to make head-ornaments for the dance. After we had been with them a little while, they seemed to come to the conclusion that we did not intend to eat them, and were not such bad fellows as they at first thought. It was what sailors call "dirty weather," so that when we returned to the ship with our wood and pigeons, we were ready for a bath and a dry suit. Before we left next morning some of the boys went off, and brought back thirty-three pigeons before breakfast, and the natural consequence of so much pigeon-eating was that on the following day the doctor had more to do than the steward.

We visited the coast of the mainland opposite Constance Island, hoping to get our little steamer into what appeared to be a bay or inlet, or perhaps a

river. We found the approach shallow, were obliged to anchor about a mile and a half from the entrance in 9 feet of water, although there is probably a deep channel. Several canoes came off, but the natives were unarmed, and had evidently but one idea, viz. barter. Their canoes were the first I had seen in New Guinea with sides, although the natives themselves are not near so fine a looking race as the Kerepunuites. Their ear-ornaments are peculiar. Instead of piercing their ears, a bunch of beads is fastened to each end of a string which is passed behind the head, so that the beads hang over the front part of the ears. They have but few ornaments, and appear to be but a poor people. We steamed out into deeper water for anchorage for the night, and next morning Mr. Lawes and I started in the small boat, with three natives, to see what the place was like. By keeping to the eastern side of the opening, we found the water from 3 to 5 fathoms deep. There is a bar at the entrance, which runs nearly across, but by keeping near the bluff on the east side of the opening, a narrow passage will be found, from 4 to 5 fathoms deep. The bluff is above 100 feet high and wooded. On the opposite side is both land and a sandy beach. After pulling half a mile from the bluff, we opened into a lagoon, about 5 miles in circumference, in which is the village of *Aloma*, consisting of about fifty houses built over the water on piles. This lagoon is shallow in the middle and nearly 3 fathoms deep at the sides. Proceeding across the lagoon, in a north-easterly direction, we found a passage about half a mile wide, along which we pulled for about a mile, when we opened into a beautiful lagoon, 4 miles long and 2 wide, with a village on a sandbank, nearly a mile from the eastern side, consisting of about thirty houses. On each side, and before us, the hills were near, though the banks of the lagoon are not well defined, as the trees grow for some distance out into the water. Pulling across this lagoon, which is only half as salt as sea-water, we found what we now concluded to be a river, 20 yards wide and 3 fathoms deep, bearing to the east. About a mile and a half further up it branches off in two different directions, one towards the south-east, the other to the north-west. We followed the south-east arm about a mile, and then returned, leaving it, no doubt, meandering amongst the hills. The highest point we reached was about 9 miles from the bluff, and we left the river, still about 20 yards wide and 3 fathoms deep. For the exploration of such rivers as these a steam-launch is necessary. It is dangerous as well as hard work to pull a boat a long distance in such a climate. On our way back we called at the village in the large lagoon; the people were very frightened, families were in their canoes on the opposite side of the village ready for flight. There were some miserable-looking pigs running about under the houses, which seemed as much afraid as their owners, but had they known our feelings respecting them, they would have felt that there was no cause for alarm. After some time, we managed to get some of the men off in their canoes with vegetables to sell for beads, and left them on the most friendly terms. The lagoon is a most picturesque spot. We have named it *Murshall Lagoon*, and the river we have called *Devitt River*, which is another known easy route to the mountains. To distinguish the bay, which has no name on the chart, we propose calling it *Shallow Bay*; it bears about north from Constance Island.

From Shallow Bay we continued our voyage inside the barrier-reef to Cloudy Bay, where we anchored between a long reef and Eugenie Islet; this islet is not in the middle of the bay, as was supposed, but near the west side. Cloudy Bay is rightly named; it has a very gloomy appearance. The clouds never seem to leave the hills in that locality, and the hills are all densely wooded, giving them a very dreary aspect. Judging from the little smoke to be seen, we suppose that the place is very thinly populated. Three miles from the north-east of Eugenie Islet is a small island, about 100 feet high

and 2 miles in circumference, well wooded; on the east side of which (and probably on the west, too) there is a good deep channel into the inner bay. To the east of this island is another, which is low, well-wooded, and about  $2\frac{1}{2}$  miles long; it is separated from the other by a passage 150 yards wide, which looks deep, but we did not go through it. Between these two islands and the mainland, a distance of 3 miles, is a fine bay, 3 fathoms deep wherever we sounded; at the head of which there appeared to be a creek or river, which we did not examine. Pulling in an easterly direction past the two islands, we landed at a point opposite the opening at the east side of the low island, where there are a few coconut-trees and oysters. From this point to the land opposite the distance is about 200 yards. Proceeding eastward, we entered a beautiful harbour, bearing about north-east, three-quarters of a mile wide and 5 or 6 miles long, and 3 fathoms deep, surrounded by thickly-wooded hills, which slope down to the water's-edge. There did not appear to be any villages on the shores of the harbour, although landing-places and native tracks appeared in several places. This harbour may be the scene of busy European life at no distant date. We have named it Robinson Harbour, and the two islands the Sewell and Percy Islands; the high one being Sewell, and the low one Percy Island. We returned by the passage to the east of Percy Island, which is from 3 to 5 fathoms deep. The best entrance both to the island and the bay behind the two islands is by this passage, entering from the east side of Cloudy Bay. We went in at the west side and left by the east; the former is rendered intricate by numerous reefs. On our return to the ship we found a large canoe close by, full of women; there not being a man on board, we felt sure that we were near the much-spoken of *Haine Anua*, Woman's Land, and the Raratongan teachers had been off and learnt this fact from the women themselves. They told them that we would be back soon, and asked them to wait. Having returned weary and hungry, and finding that the steward had a pretty good spread-out on the skylight, we fell to at once, waving to our fair sailors to come and join us, intending, however, to pay them a visit after dinner; but they, true to their sex, could not brook such treatment, and, to our chagrin, hoisted their sail and left us.

Thence we steamed to a village at the east head of Cloudy Bay, which should be Colombier Point, although it is really between the two places marked on the chart as Colombier Point and Table Point. It is very desirable that a thorough survey should be made of Cloudy Bay, and, indeed, the whole of the south coast of the peninsula. We had hoped that this village would turn out to be the Woman's Land, but before we got to anchor the men were swimming off with articles for trade. It does not appear that any white men had been there before. We visited their village on the following day, whilst the crew were cutting wood. It was with great reluctance and fear that they allowed us to approach the village. For a long time they took us by the hand and desired us to embark again, giving us to understand that the women and children were afraid, although, from the look of all parties, it appeared that they themselves were most concerned in the matter. We tried to assure them of our peaceful intentions, and moved along the beach towards the village. After many stoppages and entreaties, which we found were only meant to gain time, we reached the village, which consists of 15 or 20 houses, surrounded by a strong stockade about 14 feet high. The entrances were all barricaded, on our account, no doubt. From the inside the women were peering at us like pent-up cattle, whilst the men stood guard outside. They seemed to be satisfied before we left of our peaceful intentions, and asked us to come again. They were greatly astonished, like all the others, indeed, along the coast, at our white skins and umbrellas, and were very anxious to get hoop-iron. The

village is called *Dedele*. Leaving there, we steamed to a small island on the barrier-reef, called Grange Island, to fill up with wood. The island is much the same as Constance, but the anchorage is not so good. Some of the natives went on shore in the evening, and returned with 53 pigeons and some flying foxes. We remained there a whole day, cutting wood for fuel.

On the morning of the 13th we started for Amazon Bay, at the mouth of which are five small islands, connected, or nearly so, by reefs, between which and the mainland there is good safe anchorage at all seasons. The entrance both from east and west is near the mainland; and about a mile wide. Two of the Amazon isles are covered with coconut-trees, on one of which we found good water, although not much of it. We found good anchorage behind these two islands. Toulon Island is the largest of the group, and contains groves of coconut-trees, and a large village. Several canoes came off full of natives, all anxious to get hoop-iron. They were unarmed, and were accompanied by women and children. Some large canoes were hauled up on the beach of the mainland, where the natives from the islands appear to make plantations. The hills about Amazon Bay are thickly wooded, and some of them slope down to the water's edge.

On the following morning we steamed out of Amazon Bay on the east side, passing what we feel pretty sure will prove to be a large island, as we saw nearly through the passage. We noticed several villages on the hills, and smoke in many places. One of these villages was near the top of a mountain, nearly 1000 feet high. From Amazon Bay to China Straits we found the coast thickly populated. We steamed along inside Dufaure Island, between which and the mainland there is good anchorage. A number of canoes came off from the island; but we did not stop to hold any intercourse with the natives, being anxious to get to the opening ahead before dark, which looked like the entrance to a lagoon, or deep inlet. We kept on our way to the eastward, past Dufaure Island, between the east side of which and the mainland the passage is only about three quarters of a mile wide. Proceeding through a clear opening about a mile wide, we entered a magnificent harbour, about 8 miles long and 4 wide, from 8 to 10 fathoms deep, with a muddy bottom. On the shores of this harbour are numerous sandy beaches of considerable length, with groves of coconut-trees and villages, from which small fleets of canoes issued, and fastened on to us as we passed along. Our decks were soon crowded, which of course we should not have allowed had there been any signs of hostility. To those acquainted with natives such designs cannot well be concealed. The natives had some spears and clubs with them, but they were evidently for defence or for sale. There were no signs, as up the Fly River, of a pre-arranged, well planned, and determined attack. We anchored near the shore, about half-way up the harbour, at what we considered would be a convenient place for cutting fuel. We were glad when the darkness led our new acquaintances to clear out for the night. They appeared to be a peaceful, intelligent people. They are certainly a noisy, merry set of fellows, all wild after hoop-iron.

All along the coast, between Amazon Bay and China Straits, the natives are not only more numerous, but more intelligent, and look more healthy. They dress very respectably compared with the natives to the westward; the women are much the same, wearing girdles of grass, or leaves down to their knees, but the men have a very decent kind of fore-and-aft rig, made with pandanus leaves. During the night the natives were assembling on the beach opposite our anchorage ready for trading in the morning. They kept up a constant chatter throughout the whole night, and at daybreak eighteen canoes came off with vegetables for sale. Amongst them were a lot of young fellows who appeared to have made up their minds not to go back empty-handed, and did not seem at all particular how they came by the things. Some of

them had got the furnace-door in their canoe, others the windlass handle, and others a blanket. These we recovered; but fearing lest we should come into collision with the people if we remained to cut wood, we weighed anchor and steamed away from them. Like the natives at the other places, they were astonished when we quietly moved from the midst of their canoes. On our way out of the harbour we met numerous canoes, but did not stop. Orangerie Bay is very thickly populated, more so than any part of the coast we have yet visited. We went out at the passage between Dufaure Island and the mainland, or what may prove to be a large island, as we did not go to the head of the harbour, where there appeared to be an opening. Orangerie Bay is likely to become the most important part of the south-east peninsula, both from a missionary and commercial point of view. Our important discovery we have named *Mullens Harbour*.

To the east of Eagle Point there are numerous bays and sandy beaches, every one of which is studded with villages. The hills are all under cultivation, and on every side there are indications of active life. It was blowing freshly from the s.e., against which it was difficult for our little steamer to make headway, especially with wood fuel, so we ran into what appeared to be a bay, likely to afford shelter, about a mile to the west of the most western of the Roux Islands, and found what will probably become one of the most fine harbours along the coast. Nothing could be more convenient and safe for a ship's ear. When opposite, you run right in for the middle, steering north, and at the head of the bay bear to the east, and you find yourself in a beautiful cove, safe from all winds, surrounded by lovely hills, at the base of which are sandy beaches, groves of coconut-trees, and two or three villages. The people are quiet and friendly, and not too numerous to manage, as at Orangerie Bay. They came off to us with vegetables, and curious iron-hoop; and we went on shore, where we got plenty of wood, and good water from a running stream. So that vessels passing may run in here for wood, water and vegetables, and in a few minutes pass from a high sea to a quiet anchorage.

We were rather surprised and pleased to find how much attention and respect they showed towards their dead. Close to the village we observed a grave, neatly enclosed by a low stone wall. At the head, two japan apples were growing, and some crotons at the feet, the enclosure being well weeded. It was here that we first met with a remarkable style of canoe, which we afterwards found more common as we neared the Straits. These war or state canoes looked very handsome and graceful when moving along at a distance under paddles. They are elaborately carved, and decorated with white shells and streamers; high at each end, and worked off in scrolls, looking like two great swans white as snow. Inside, the carved work is sometimes painted red or black, but nearly the whole of the canoe is kept beautifully white. Carved birds, &c., are fastened on sticks, and stuck into different parts of the canoe. Even the outrigger is painted in stripes of white and black which, at a distance, when the canoe is being pulled by twenty men who are all hidden but their heads and shoulders, gives it the appearance of an old Roman galley.

From this point eastward the natives seem very fond of carving. Their chinam pots and spoons, sago batons, clubs and spears, canoes and paddles, and all their ornaments, are skillfully carved, and almost every one of them, except the canoes, may be bought for a piece of hoop-iron. During the night the news of our arrival spread, and in the morning we were surrounded by thirty-four friendly canoes. Their could be no mistaking their peaceful intentions. Some of the natives helped our men to cut and carry wood, and one of them slept on board the *Ellangowan*. Although the cove itself is a nice quiet place, there are plenty of natives in the vicinity. To the east as well as to the west there are numerous sandy beaches and coconut-groves,

swarming with natives. The entrance to the cove is easily known by a remarkable-looking rock, on which stands a prominent tree on the east side of the bay, about half a mile from the land. We have named it *Runcie Rock*, and the anchorage *Isabel Cove*.

Proceeding to the eastward, we soon sighted what we supposed to be "Tree Island," but which turned out to be "Wedge Rock." There is no island off the western head of Farm Bay as marked upon the latest charts, and this is very misleading to vessels running along the coast, as there is one within 8 miles corresponding to the description of what has hitherto been supposed to be the South Cape of New Guinea, but which we have proved to be an island by passing, in the steamer, between it and the mainland. Entering the bay between Rugged Head and Wedge Rock, we steamed about 3 or 4 miles, and then opened up a fine passage, half a mile wide, and 5 fathoms deep, by which we entered Catamaran Bay. What was supposed to be the South Cape of New Guinea, we have named *Stacey Island*. As we opened up the passage, we saw what appeared to be unbroken land on both sides for 12 or 14 miles, and wondered where we were going. As we proceeded, however, the passages between Stacey, Tissot, and the Brumer Islands opened up to the south. There is good anchorage between Stacey Island and the mainland. The island is hilly, the highest peak being about 600 feet above the level of the sea. It is triangular in shape, about 4 miles long, and populous. At the head of the bay opposite the passage between Stacey Island and the mainland, there is a bay running to the westward, which probably meets the one running eastward at the top of Farm Bay, making Rugged Head an island also; so that the southernmost extremity of New Guinea cannot yet be fixed with certainty. As we were on a Missionary voyage, looking for suitable places to establish mission stations, we did not feel justified in spending more time for the solution of these points. Our discoveries will show that there is plenty of important work for one of Her Majesty's ships all along the southern side of the peninsula; and although we do not profess to be accurate in our positions, we hope that the information gained, and willingly given to the public, will be of service until a proper survey is made by appointment of the Government. In the mean time, it is to be devoutly hoped that all vessels visiting the coast will, in the interests of commerce, as well as of humanity and religion, strictly observe a peaceful policy with the unsuspecting natives.

We came to anchor for the night at the west end of the Leocadie Islands, between a long reef and the mainland, and were very soon surrounded by a number of canoes and catamarans; but the natives, as at the other places, appeared friendly. We did not find during our voyage any of those signs of hostility and treachery which are mentioned in the Directory. When we started on the following morning at half-past six o'clock there were forty-five canoes around the *Ellungowan*. The natives were all clamouring for hoop-iron, but our supply was far short of the demand, which led us to cut up one of the old plates of the ship, which, being thicker, was greatly prized. Any person visiting these parts should take a large supply of pieces of good thick hoop-iron, about an inch and a half wide and 6 inches long, and sharpened at one end, with these he may obtain vegetables and valuable curiosities.

We steamed into China Straits to the west of Heath Island; 3 miles from which, in a westerly direction, there is an island close to the mainland, 300 feet high, and three-quarters of a mile long. Off the north end of Heath Island are two small islands, nearly joined to it at low tide, which are woody, contain several groves of coconut-trees, and are inhabited. Many canoes came off from Heath and Hayter Islands, which appear to be thickly populated. They seem to use all kinds of canoes in and about China Straits, from the catamaran up to the beautiful white war canoes; and several kinds, of sails from the large one I have described, down to a common plaited

coconut-leaf. Entering Possession Bay, we saw a brig at anchor at the north side of Mekinley Island, which we passed, and found to be the *Rita* of Sydney. The crew were on shore cutting wood, where a tent was erected. The captain said they were fishing for *bêche-de-mer*, had been out ten months, and at Mekinley Island ten days, and about to leave. Having got a view of Jenkins and Milne Bays, we returned to Possession Bay, where we anchored for the night. This is a rather gloomy place, from the absence of any native village, and the mangroves all round the bay.

On the following day twelve of the large white canoes called at the *Ellangowan* on their way to Milne Bay, also a number of small ones. All were anxious to get hoop-iron. In addition to clubs and spears they had a great many stones laid along the sides of the canoes, to be used as shot, no doubt, in case any disturbance took place, but, like the others, they did not seem disposed to quarrel. The natives from Heath Island appear the most tractable, and were wild with delight when they found that we were going to anchor for the night near them. We were sorry that we had not more hoop-iron for the poor fellows; it was the one article in demand, and there was little use extending our voyage without it. If we had had a supply, we might have gone as far as Moresby Island; but the object of our voyage was accomplished, which was chiefly to find, if possible, during the calm season, anchorages along the coast into which we might run in heavy weather, and without steam, if thought desirable, after we have established our mission along the coast, and to look out for suitable places for the location of native pioneer missionaries. We are happy in the successful completion of a very interesting voyage. We think that all along the coast friendly relations might be easily established and maintained with the people; and it is our intention to commence, as early as practicable, a Mission in China Straits to work eastward and meet the one already established at Port Moresby. The eastern end of the peninsula, with the islands in the vicinity, including the D'Entrecasteaux group, will form a much finer field for Missionary operations than the Gulf, with its dangerous navigation, deadly fever, and savage cannibal inhabitants.

Our voyage has also been one of important discovery. We have found two rivers, two splendid harbours, a safe, snug and convenient cove, several islands, and plenty of good anchorages all along the coast. We have found the natives numerous and friendly, looking healthy, and apparently in the midst of plenty of food. They brought off to us some flax, in small quantities, of a superior quality, which might become an article of commerce. With that exception, we did not see anything of commercial value. The country may be rich, and probably is, in mineral wealth, but it has yet to be found. At present it is a fine field for missionaries, naturalists, and explorers, who will best prepare the way for settlers.

Our return voyage to Port Moresby was accomplished in a few days. We ran back under sail most of the way outside the barrier reef, calling at Isabel Cove, and Hood Lagoon (Kerepunu) arriving at Port Moresby about 8 p.m. on Saturday, April 22nd, where we found all well. On Saturday the 29th we left for Cape York; calling at Yule Island for wood fuel. Here we found Dr. James considerably reduced by fever, and anxious to go to Cape York to recruit his health. He intends returning in the *Ellangowan* next month, to continue his collecting in the vicinity of Yule Island. From Yule Island we had a pleasant passage to Cape York, where we arrived on the 6th of May, having called at Darnley and York Islands.

Those who take special interest in the movements of our little steamer *Ellangowan*, will be pleased to learn that she has served us admirably well, exceeding our highest expectations. For two years we have had her constantly employed, burning chiefly wood; she has enabled us to open up our Mission field, which we could not have done without steam.

PRIZE MEDALS  
OF THE  
ROYAL GEOGRAPHICAL SOCIETY.  
-----  
REPORT FOR 1877,  
AND  
PROGRAMME FOR 1878.



## SYNOPSIS OF RESULTS

OF

## PAST EXAMINATIONS.

Physical Geography.

1869.—*Examiner*, A. R. WALLACE.  
(*Special Subject : Palestine.*)

Gold Medal .. .. W. GRUNDY.  
(*Rossall*)

Bronze Medal .. .. G. W. GENT.  
(*Rossall*)

Honourably Mentioned G. G. Butler, M. Stewart, A. Wilson, G. B. Brown, E. Thomas.

1870.—*Examiner*, A. R. WALLACE.  
(*Special Subject : India.*)

Gold Medal .. .. G. G. BUTLER.  
(*Liverpool College.*)

Bronze Medal .. .. M. STEWART.  
(*Rossall*)

Honourably Mentioned W. Hind, G. Hughes, F. J. Beckly, F. W. Hunt, R. F. W. Shaw, E. C. Thomas.

1871.—*Examiner*, Dr. W. B. CARPENTER, F.R.S.  
(*Special Subject : British North America.*)

Gold Medal .. .. D. McALISTER.  
(*Liverpool Inst-tut*)

Bronze Medal .. .. W. G. COLLINGWOOD.  
(*Liverpool College.*)

Honourably Mentioned R. A. Lundie, W. N. Shaw, W. C. Hudson, F. J. Beckley, T. Disney, W. E. Evill, H. R. F. Brown, W. B. Ffooks.

1872.—*Examiner*, H. W. BATES, F.L.S.  
(*Special Subject : South America.*)

Gold Medal .. .. S. F. SPRING-RICE.  
(*Eton College.*)

Bronze Medal .. .. A. S. BUTLER.  
(*Liverpool College.*)

Honourably Mentioned C. Penrose, E. Dickson, J. R. White, H. de V. Vane.

Political Geography.

*Examiner*, Rev. W. G. CLARK.

H. C. RICHMOND.  
(*Liverpool College.*)

J. D. WILDE.  
(*Manchester Grammar School.*)

E. Crabb, J. H. Collins, M. L. Lewis, H. B. Dixon, D. S. Bontflower.

*Examiner*, Very Rev. Dean HOWSON, D.D.

G. W. GENT.  
(*Rossall*)

J. H. COLLINS.  
(*Liverpool College.*)

E. Crabb, William Grundy, George Hogben, J. D. Murray, H. B. Dixon.

*Examiner*, C. H. PEARSON, M.A.

G. HOGBEN.  
(*University School, Nottingham.*)

R. N. ARKLE.  
(*Liverpool College*)

F. M. Sparks, J. B. Heath, D. S. Bontflower, A. Hassall.

*Examiner*, T. W. HINCHLIFF, M.A.

W. G. COLLINGWOOD.  
(*Liverpool College.*)

W. C. GRAHAM.  
(*Eton College*)

R. H. Sayle, W. L. Kingsford, H. E. Dixon.

**Physical Geography.**

1873.—*Examiner*, Dr. J. D. HOOKER, F.R.S.  
(*Special Subject: Eastern and Western Turkestan.*)

Gold Medal .. .. W. C. HUDSON.  
(*Liverpool College.*)

Bronze Medal .. .. W. A. FORBES.  
(*Winchester College.*)

*Honourably Mentioned* A. C. Cole, R. C. Reade, H. H. Hancock, H. Louis, N. M. Richardson, G. S. Pawle, G. R. Townsend, W. S. Widdicombe.

1874.—*Examiner*, Prof. A. C. RAMSAY, LL.D.  
(*Special Subject: The British Isles.*)

Gold Medal .. .. L. WESTON.  
(*City of London School.*)

Bronze Medal .. .. F. C. MONTAGUE.  
(*University College School*)

*Honourably Mentioned* H. M. Platnauer, W. S. Widdicombe, C. A. Spring-Rice, H. A. Miers, C. Healey, W. F. Wilson, A. R. Forsyth.

1875.—*Examiner*, General R. STRACHEY, R.E.  
(*Special Subject: China.*)

Gold Medal .. .. H. A. MIERS.  
(*Eton College.*)

Bronze Medal .. .. A. E. GARROD.  
(*Marlborough College.*)

*Honourably Mentioned* C. A. Spring-Rice, H. Perrin, H. H. Hancock, W. D. Thomson, H. M. Platnauer.

1876.—*Examiner*, Prof. T. RUPERT JONES, F.R.S.  
(*Special Subject: The Arctic Regions.*)

Gold Medal .. .. JNO. WILKIE.  
(*Liverpool College.*)

Bronze Medal .. .. WALTER NEW.  
(*Dulwich College.*)

*Honourably Mentioned* J. A. Robinson, L. P. Jacks, E. von Lengerke, Sir M. Crofton, F. S. Carey.

1877.—*Examiner*, FRANCIS GALTON, M.A., F.R.S.  
(*Special Subject: Africa, South of the Equator.*)

Gold Medal .. .. WALTER NEW.  
(*Dulwich College.*)

Bronze Medal .. .. ARTHUR SMYTH FLOWER.  
(*Winchester College.*)

*Honourably Mentioned* John Chisman, J. A. Robinson, Frank Stanton Carey.

**Political Geography.**

*Examiner*, Maj.-Gen. Sir H. C. RAWLINSON, K.C.B.

S. E. SPRING-RICE.  
(*Eton College.*)

A. T. NUTT.  
(*University College School.*)

A. Williams, W. L. Kingsford, G. H. Sing, S. H. B. Saunders, A. Hassall.

*Examiner*, Rev. Canon RAWLINSON, M.A.

W. H. TURTON.  
(*Clifton College.*)

L. JACOB.  
(*City of London School*)

J. F. Heyes, S. H. B. Saunders, R. W. Whiston, W. B. Styer.

*Examiner*, Sir RUTHERFORD ALCOCK, K.C.B.

S. H. B. SAUNDERS.  
(*Dulwich College.*)

W. C. GRAHAM.  
(*Eton College.*)

J. Vans Agnew, W. M. H. Milner, J. F. Heyes, D. G. Crawford, T. Knox, A. S. Moriarty.

*Examiner*, Sir F. LEOPOLD MCCLINTOCK, F.R.S.

THOMAS KNOX.  
(*Haileybury College*)

W. M. H. MILNER.  
(*Marlborough College.*)

J. B. Johnston, H. W. Pigeon, J. F. Heyes, W. J. Newton, A. R. Ropes, C. W. MacMaster.

*Examiner*, Sir RAWSON W. RAWSON, K.C.M.G., C.B.

William John Newton.  
(*Liverpool College.*)

John Wilkie.  
(*Liverpool College.*)

Arthur Reed Ropes, William Wallis Ord, Samuel Fowler Blackwell, George Arnold Tomkinson, Henry Colthurst Godwin.

TABULAR SUMMARY OF AWARDS OF MEDALS ACCORDING TO SCHOOLS.

Total.		GOLD.		BRONZE.			
		Physical.	Political.	Physical.	Political.		
2	City of London .. ..	1871	.. ..	.. ..	1874		
1	Clifton .. ..	.. ..	1871	.. ..	.. ..		
3	Dulwich .. ..	1877	1875	1876	.. ..		
5	Eton .. ..	1872, 1875	1873	.. ..	1872, 1875		
1	Haileybury .. ..	.. ..	1876	.. ..	.. ..		
11	Liverpool College .. ..	1870, 1873, 1876	1869, 1872, 1877	1871, 1872	1870, 1871, 1877		
1	Liverpool Institute .. ..	1871	.. ..	.. ..	.. ..		
1	Manchester School .. ..	.. ..	.. ..	.. ..	1869		
2	Marlborough .. ..	.. ..	.. ..	1875	1876		
1	Nottingham .. ..	.. ..	1871	.. ..	.. ..		
4	Rossall .. ..	1869	1870	1869, 1870	.. ..		
2	University College School .. ..	.. ..	.. ..	1874	1873		
2	Winchester .. ..	.. ..	.. ..	1873, 1877	.. ..		
36 in nine years—13 Schools.							
Liverpool College .. ..	11	Dulwich .. ..	3	Winchester .. ..	2	Haileybury .. ..	1
Eton .. ..	5	City of London .. ..	2	University College School .. ..	2	Liverpool Institute .. ..	1
Rossall .. ..	4	Marlborough .. ..	2	Clifton .. ..	1	Manchester School .. ..	1
		Nottingham .. ..	1				

PRIZE MEDALS  
OF THE  
ROYAL GEOGRAPHICAL SOCIETY.  
INSTITUTED, 1869.

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RESULTS OF THE EXAMINATION FOR 1877.

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*List of Schools who were invited to compete in 1877.*

*English Schools.*—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

*Channel Islands School.*—Victoria College, Jersey.

*Scotch Schools.*—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School; Glasgow Academy.

*Irish Schools.*—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College; Rathmines School, Dublin.

Seventeen of the above Schools furnished competitors, according to the following list, in which is entered the number of candidates in Political and Physical Geography from each school:—

	Physical.	Political.
Marlborough College .. .. .	1	1
Rathmines School, Dublin .. .. .	0	2
Victoria College, Jersey .. .. .	2	0
Brighton College .. .. .	1	1
University College School .. .. .	2	1
Charterhouse School .. .. .	0	1
Eton College .. .. .	1	0
City of London School .. .. .	2	2
Clifton College .. .. .	0	4
Haileybury College .. .. .	0	2
Liverpool College .. .. .	4	2
Dulwich College .. .. .	3	1
Edinburgh High School .. .. .	0	1
Bristol Grammar School .. .. .	2	0
Cheltenham College .. .. .	2	1
Rossall School .. .. .	1	1
Winchester College .. .. .	1	0
Total ..	22	20

The Examiners appointed by the Council for 1877 were Francis Galton, Esq., F.R.S., for Physical, and Sir Rawson W. Rawson, K.C.M.G., for Political Geography. The examinations were held at the various schools, on the 19th of March, and the Prizes were presented at the Anniversary Meeting of the Society.

The special subject for the year 1877 was—

AFRICA, SOUTH OF THE EQUATOR.

## PHYSICAL GEOGRAPHY.

### No. 1 EXAMINATION PAPER, 1877.

#### General.

[Candidates are required to answer not less than the specified number of Questions in each Group.]

#### Group A (THREE Questions must be answered).

- (1). Draw a circle of about four inches in diameter, to represent a section of the Globe through the mean Sea-level at N. Lat. 35°. Write the names of the more important places and districts through or near which it passes, inserting them (radially) in their proper longitudes, and within or without the circle, according as they lie to the N. or S. of it.
- (2). On a circle, similar to that specified in the last Question, write the approximate elevations of such Plateaux and Mountains, and of such depressions of Sea-bottom in or about N. Lat. 35° as you may remember (in all cases omitting units and tens of feet). Guided by

these entries, describe on the circle a section of the Land and Sea. Make it on the scale of about  $\frac{1}{20}$  of an inch for each 1000 feet of vertical elevation or depression, and indicate the land with a red pencil, and the water with a blue one.

- (3). Two lines are drawn on a globe from Cape Horn, the one passing continually to the N.W., and the other to the N.E. Through what places will they pass, whereabouts will they intersect for the first time, and what, in general terms, will be their subsequent courses?
- (4). A globe is put into a cubical box, which it fits. One side of the box touches the globe in N. Lat.  $55^{\circ}$  and Long.  $0^{\circ}$ ; another side is known to touch it at a point somewhere on the Equator. What districts on land or sea are adjacent to each of the six points at which the globe is touched by the box? Give a list of the latitudes and longitudes of those six points.
- (5). Give a concise and general summary of the distribution of Land and Sea over the Globe.

**Group B** (*this Question must be answered*).

- (6). Suppose a geographer, unprovided with instruments, to be set in the month of March, for the space of twenty-four hours, by a desert watering-place in one or other of the following regions:—Sahara, Gobi, Australia, Utah, Kalahari. By what indications of sky and air, of plants, of animals, of tracks of travellers, and traces of their encampments, could he form an opinion in which of them he was?

**Group C** (*ONE Question must be answered*).

- (7). Explain the various conditions by which Ocean-currents may be produced? How are the Currents in the British Channel affected by the Tides?
- (8). What are Isothermal Lines? Define a "mean." In what way are mean temperatures determined approximately, and in what way accurately? What is the general direction in January and July respectively, of the Isothermal that passes through London? Why is its direction different in those months?
- (9). What are Cyclones and Anticyclones? Of what nature and area are the Storms that usually pass over the British Isles? Whence do they come, at what rates do they travel, and where do they appear to disperse? What is the meaning of "Barometric Gradients"? State what you know about them.

**Group D** (*THREE Questions must be answered*).

- (10). What are the supposed causes of Volcanic action? Describe the principal Volcanoes between Australia and Kamtchatka.
- (11). Account for the size and shape of the grains of ordinary Desert Sand. What is the process by which ripple-marks are formed on its surface by wind? Explain the nature of Sand-dunes: how is it that they change their positions? Give instances of their doing so. What is Sandstone?

- (12). What is the evidence of Rocks having been transplanted on a large scale, and to many regions, by drifting Ice? Describe the whole of the process.
- (13). How are Deltas formed, and what is their stratification? Give examples to illustrate the rate of their formation at the mouths of large rivers.

**Group E** (*THREE Questions must be answered*).

- (14). Describe the more striking features and characteristics of a Brazilian Forest by the Lower Amazon.
- (15). How might it be shown, from the Biblical accounts of the fruits and cereals of Palestine, that the climate of Syria has not materially altered since the beginning of the Christian era?
- (16). Give a list of the Animals domesticated by man, and state, so far as has been ascertained, the countries in which they were indigenous.
- (17). What do we know of the races of the men and of their habits, who lived in Europe in prehistoric periods? What is the nature of the evidence on which the phrase "Indo-Germanic race" is founded?

**Group F** (*this Question must be answered*).

- (18). Draw a map from the following notes, on the scale of about half an inch to a mile:—

I climbed to **P**, the highest point in the island. The ridge **PQ**, on which it stands, runs generally W. and E., but it curves somewhat to the northward before ending westward in **A**, a narrow promontory. The inland face of **PQ** is steep and escarped. **CD** is the crest of a long low hill parallel to **PQ**; its further side forms the cliff of the northern coast. A stream runs W. down the valley at the foot of **PQ**. From **P**, I took a round of bearings as follows:—to **A**, W.N.W.; to **B**, N.W.; to **C**, N.; to **D**, E.N.E.; to **E**, E.S.E.; to **G**, S.S.E.; to **H**, S. Then I made my way along the ridge to **Q**, 6 miles E. of **P**, whence I took a second round of bearings as follows: to **B**, W.N.W.; to **C**, N.W.; to **D**, N.E.; towards **R** (the termination of the ridge  $1\frac{1}{2}$  mile off), E.S.E.; to **F**, S.; to **G** and **H**, both in same line, W.S.W. **A** could not be seen from **Q**, but when seen from **P**, it was judged to be in a line with **B** and **C**. As regards the objects to which these letters refer, **B** is the mouth of the stream, in a shingly delta extending  $\frac{1}{4}$  mile to seaward between two shallow bays. **C** is the west end of the ridge **CD**, and **D** is its east end. **E**, **F**, **G**, and **H**, are all of them capes formed by spurs from the main ridge. Between **D** and **R** there is a bay, deepest immediately to the north of **R**. The coast between those points is low, but the land rises at the back, and soon reaches the watershed. Between **G** and **H** is a deep narrow bay. Between **F** and **G** the coast is steep, but broken by ravines. From **H** to **A** the coast sweeps round the spurs of the main ridge in a bold curve. The Altitudes are as follows,—**P**, 3000 feet; **Q**, 2000; intermediate part from 1000 to 1500; **A**, 150; **B**, 300; **G** and **H** both about 100; the northern cliff's uniformly about 200; and the ridge **CD** rarely exceeds 300.

A bird's-eye view of the island may be annexed.

## NO. 2 EXAMINATION PAPER, 1877.

**Special.**

*[Candidates are required to answer not less than the specified number of Questions in each Group.]*

**Group A** (Two Questions must be answered).

- (1). What is the general conformation of South Africa, and what are the chief data through which it has become known or inferred? Illustrate the shape of the country by a section at or about the latitude of Quillimane, showing the character of the underlying rocks.
- (2). Draw a roughly-outlined Map of South Africa, containing a few of the principal names, on as large a scale as a page of the paper you are using will conveniently hold. Write thereon the elevations of the Plateaux, Lakes, and Mountains (not regarding units and tens of feet), and draw contour-lines of 1000, 2000, 3000, and 4000 feet respectively. Dot the Districts that receive excessive Rainfall with a blue pencil, and those that are arid with a red one.
- (3). Describe the more prominent features and characteristics of the Lakes Tanzanyika, Nyassa, Bangweolo, and Ngami. In what direction is Lake Dilólo said to discharge its waters?

**Group B** (Three Questions must be answered).

- (4). Describe the Ocean-currents and prevalent Winds on the Eastern and Southern coasts of South Africa. How do the Currents affect the Sea Temperature of Table Bay and the Climate of the Coast of Namaqua Land?
- (5). Give a short description of the Island of Madagascar, and point out its African affinities. Why was the Island of St. Helena peculiarly well adapted for the safe custody of Napoleon I. by the English?
- (6). By what conditions are the Rains in South Africa mainly governed? What, approximately, is the amount and duration of Rainfall in the central districts between the Lualaba and the Zambesi; and what is it immediately to the south of the Victoria Nyanza? What is meant by the "Smokes"? Describe and explain the so-called "Table-cloth" of Table Mountain.
- (7). What is the amount of Water poured into the sea, by each of the principal Rivers of South Africa? Compare the volume of the Lualaba at Nyangwe with that of the Congo at its mouth, and of the Nile at Gondokoro. What is the character of the Great Fish River and of the rivers in Namaqua Land and Damara Land generally?
- (8). Which of the South African Rivers are in any sense navigable from the sea, and to what extent? What are the causes that usually limit the navigability of their lower portions? Describe the Falls of the Zambesi and of the Congo.

**Group C** (Three Questions must be answered).

- (9). What Domestic Animals are kept by the natives N. of the Zambesi? What Plants are grown by them? Where in those parts has the



- Tsetze Fly been observed? What portion of the country S. of the Zambesi is entirely free from it?
- (10). What, apparently, are the southern limits of the Equatorial Forest of dense vegetation? Give data for its determination.
  - (11). Mark on a rough Map the districts S. of the Zambesi where Copper, Gold, and Diamonds are respectively to be found. What indications of Gold are there in South Africa, N. of the Zambesi? Where is Katanga?
  - (12). Give a full Ethnological account of the Bushman and Zulu Races, describing their social conditions, occupations, dwellings, weapons and utensils of all kinds.

## POLITICAL GEOGRAPHY.

### No. 1 EXAMINATION PAPER, 1877.

#### General.

*[Candidates are required to answer not less than the specified number of Questions in each Group.]*

#### Group A (THREE Questions must be answered).

- (1). Explain in precise terms the meaning of Latitude and Longitude, and in general terms the methods of ascertaining each. State the difference between the Polar and Equatorial diameters of the Earth, and whether this sensibly affects the length of any degree of Latitude. At what parallel of Latitude is 1° of Longitude equal to half a degree of Latitude? If you cannot give an exact answer, give an estimate founded on your general knowledge of the Globe.
- (2). State the Latitude and Longitude of Antwerp and Melbourne, of New Orleans and Hong Kong. What are the approximate distances in nautical miles between the former two places, by the Cape of Good Hope and Red Sea routes respectively; and between the latter two places? What land do sailing-vessels approach on each of these three courses?
- (3). State the ordinary route and the distance between St. Petersburg and Khiva, and the principal Places, and geographical features of the country, on the route. Also between New York and San Francisco.
- (4). Describe the chief ascertained differences, as regards Land and Water, between the Northern and Southern Polar Regions; the causes which have led to the greater exploration of the former; and the nearest approach (giving the exact position) hitherto made to each Pole; by whom, and when, made.

#### Group B (two Questions must be answered).

- (5). Delineate the outline of the Black Sea, and of the Seas connected with it: and name the Provinces of the several Countries, and the principal Towns situated on their shores, starting Eastward from the Bosphorus.

- (6). Give the Area and Population of the British Territory in India, and of each of the principal Native States constituting part of the British Empire in that Country, with the total area and population of the latter, and the Presidency to which they belong.
- (7). State the Areas of the Mediterranean, Black, Caspian, Aral, and Baikal Seas, with their relative proportions, taking the area of the latter as the unit; name the principal Rivers flowing into each of the last four Seas, and their approximate length.

**Group C** (*Two Questions must be answered*).

- (8). Describe the principal changes made in the Boundaries of European States since the year 1815, and the order, and dates, of the Treaties by which they were made.
- (9). Describe the Boundaries, and Extent, of the Russian Empire in Asia before the time of Peter the Great, and those of the several additions which have been made to it up to the present time.
- (10). Enumerate the several Countries of South America, with the present nature of their Government, in the following Classes:
  1. Those which are now under a foreign dominion, specifying the Countries to which they belong.
  2. Those which were once, but have ceased to be, under a foreign dominion, distinguishing the Countries to which they formerly belonged.
  3. Those which have never been under a foreign dominion.

**Group D** (*Two Questions must be answered*).

- (11). What are the chief lines of Overland Commerce between China and other parts of Asia; and what were the chief lines between China and Europe in the time of the Roman Empire? What Ports in China are now open to foreign trade?
- (12). What Countries would be most affected by the construction of a Ship Canal across the Isthmus of Panama; and which Channel would, at present, be most valuable to the commerce of the world, that Canal, or the Suez Canal, giving the reasons for your opinion?
- (13). How far does the local position of the Ports of Liverpool, Bristol, Hull, Glasgow, and Belfast, account for the rise and growth of the Trade of each?

**Group E** (*Three Questions must be answered*).

- (14). In what manner, and to what extent, have the various geographical conditions of the Continents of Europe and Africa promoted, or hindered, Civilisation within their respective areas?
- (15). What have been the differences in the systems and results of Colonisation by the different nations of Europe within the last four centuries?
- (16). Enumerate the principal, generally recognised, Types of the Human Race, and the Regions which they occupy throughout the globe. Describe the chief characters which distinguish them from one another.
- (17). In what respects does the Continent of Australia differ from all the other continents? Into what Colonies is it divided, and how are

their boundaries marked? In what respects does the population of each differ, as regards origin, present character, number, and employment?

- (18). What climatic conditions appear to have been the most favourable to the development of primitive Civilisation, and how did their influences operate?

## NO. 2 EXAMINATION PAPER, 1877.

### Special.

*[Candidates are required to answer not less than the specified number of Questions in each Group.]*

#### Group A (two Questions must be answered).

- (1). State the Latitude and Longitude of Ascension and St. Helena Crossing Africa from W. to E. on the parallel of each, name in their order the Port on the West Coast nearest to that Parallel; the principal features of the country; any considerable Native villages within a Degree of the parallel; and the Port nearest to it on the Eastern Coast. Name the travellers who have crossed Africa on, or near, either of these routes; the dates of their journeys; and the points on the coast between which they travelled.
- (2). It has been proposed to run a line of Telegraph from Upper Egypt to Cape Town. What Route would be best from Victoria Nyanza to Delagoa Bay; and thence to each of the Eastern Termini of the existing lines of Telegraph in the Cape Colony (King William's Town and Kimberley), with reference to distance, to natural facilities or obstacles, and to the knowledge already acquired of the route? What would be the advantages of selecting the one or other terminus?
- (3). Name the Islands on the East Coast of South Africa. Describe their position, area, population, nationality, and language; present degree of civilisation; and connection, past and present, with one another.

#### Group B (two Questions must be answered).

- (4). Describe the position, shape, and extent of Delagoa Bay; and its recommendations as a Harbour. Name the Countries which have claimed possession of it, and the time and circumstances of the last settlement of their claims. To what other Country would its possession be most valuable, and what would be the probable consequences of the establishment of a Free Port on its coast upon the existing trade of other ports in the neighbourhood?
- (5). Which are the most important Rivers of South Africa, as regards (1) the area which they drain; (2) the extent to which they are navigable; and (3) the access which they afford to the interior, and the importance attaching to that access in each case?
- (6). Give an account of the origin and growth of the Cape Colony, describing the additions made to its territory at different periods; its present territorial divisions; the circumstances, geographical or other, which have led to its extension, and influenced the direction of that extension; and those which now hinder its further extension in certain directions.

**Group C** (*Two Questions must be answered*).

- (7). State, as far as known, the order and date of the discoveries and settlement of each nation upon the Coast of South Africa; the extent of their explorations, and of their present possessions.
- (8). Name the chief Native Races of South Africa; tracing them from W. to E.; their connection in groups; the derivation of their names; the chief languages spoken by them, and the vocal peculiarities for which any of them are noted.
- (9). What have been the results of the occupation of each alien nation upon the indigenous population of South Africa; and what Tribes or Races have been brought under its influence?

**Group D** (*Two Questions must be answered*).

- (10). What have been the principal Ports on the E. and W. Coast of South Africa from which the Slave Trade has been carried on, and the routes from the interior by which, as far as is known, Slaves have been brought to each Port?
- (11). Explain the geographical and climatic conditions which have influenced the establishment of European Colonies on the coasts of South Africa.
- (12). What are the chief points of resemblance and difference, natural, political, and commercial, between the Colonies of the Cape and Natal; and to what results, upon the condition of each, have they led up to the present time?

The following are the names of the successful competitors:—

### PHYSICAL GEOGRAPHY.

				Age.			
<b>Gold Medal</b>	..	WALTER NEW	..	17	..	..	<i>Dulwich College.</i>
<b>Bronze Medal</b>	..	ARTHUR SMITH FLOWER	16½	..	..	..	<i>Winchester College.</i>

#### *Honourably Mentioned.*

				Age.			
JOHN CHISMAN	..	..	..	17½	..	..	<i>City of London School.</i>
J. A. ROBINSON	..	..	..	18	..	..	<i>Liverpool College.</i>
FRANK STANTON CAREY	..	..	..	16½	..	..	<i>Bristol Grammar School.</i>

### POLITICAL GEOGRAPHY.

				Age.			
<b>Gold Medal</b>	..	WILLIAM JOHN NEWTON	..	16	..	..	<i>Liverpool College.</i>
<b>Bronze Medal</b>	..	JOHN WILKIE	..	17	..	..	<i>Liverpool College.</i>

#### *Honourably Mentioned.*

				Age.			
ARTHUR REED ROPES	..	..	..	17	..	..	<i>City of London School.</i>
WILLIAM WALLIS ORD	..	..	..	17	..	..	<i>Dulwich College.</i>
SAMUEL FOWLER BLACKWELL	..	..	..	16	..	..	<i>Clifton College.</i>
GEORGE ARNOLD TOMKINSON	..	..	..	17½	..	..	<i>Hatfield College.</i>
HENRY COLTHURST GODWIN	..	..	..	18	..	..	<i>Clifton College.</i>

## REPORTS OF THE EXAMINERS FOR 1877.

## I.—PHYSICAL GEOGRAPHY.

*To the Council of the Royal Geographical Society.*

March 26th, 1877.

I HAVE no hesitation in making my awards, because the merits of the candidates appear to be clearly graduated, and the Medallists to be well worthy of their respective honours.

**Gold Medallist** .. WALTER NEW, Dulwich College.

**Bronze Medallist** .. ARTHUR SMYTH FLOWER, Winchester College.

*Honourably Mentioned.*

JOHN CHISMAN, City of London School.

JOHN ROBINSON, Liverpool College.

FRANK STANTON CABEY, Bristol Grammar School.

The candidates came from twelve different schools, and were twenty-two in number. I consider their performances to be, on the whole, very creditable to their age and opportunities.

The Papers of the Gold Medallist, Walter New, are extraordinarily good; in style and grasp he is much superior to the other candidates. He obtained the Bronze Medal in 1876, and, on referring to the report then made by the Examiner on his performance, I feel sure he must have greatly advanced during the past year in his geographical knowledge.

The answers of the Bronze Medallist, Arthur Smyth Flower, are sound and judicious, and, though they are brief, they afford ample evidence of a wide range of solid information.

There is a great deal to praise in the answers of the three boys whom I have Honourably Mentioned. Chisman was placed below the Bronze Medallist because he had not sufficiently mastered the special subject. Robinson, whose replies were written with unusual fulness, had seriously infringed the conditions of the Examination.

by attempting only one question instead of the three that were required in the first group, and by neglecting altogether the one question that was required in the last group. Carey, though generally good, was not equal on the whole to those I have already mentioned.

As regards the remainder of the candidates, I find seven who are nearly, but not quite, in my opinion, deserving of Honourable Mention. Then follow eight whose performance is of a decidedly lower level. Lastly, there are two, whose work is so meagre and bad, that I am surprised at their having been entered as candidates.

It will give a fair idea of the performance of the seventeen boys who have not obtained distinction to say that, although most of the questions required thought as well as knowledge to answer, it would be possible to extract from their aggregate replies very good answers to about three-fourths of them. On the other hand, a large collection of imperfect work and of gross errors might be extracted from the same sources.

I have the pleasure to add that some of the boys drew very effective rough diagrams as illustrations of what they desired to convey.

I will point out some common defects in the knowledge of the candidates in an Appendix to this Report, for private transmission to the competing Schools, and for the guidance of future Examiners.

The experience of this Examination induces me to recommend that Problem Questions, perhaps more or less similar in form to that of Question 6 in the General Paper, should be invariably set. They afford a far shrewder test of geographical knowledge, in its broadest and most liberal sense, than the reproduction of mere book-work. Every candidate would be able to make some reply to them, and only the best among the candidates would be able to give really good and comprehensive answers. Besides this, they much interest boys. Probably the future of Geography as a recognised subject of instruction in the higher forms of Schools and in Universities depends very much on the degree to which it may be possible to set problems in it; and I think that it would be well to suggest to future Examiners that they should always endeavour to do so.

FRANCIS GALTON.

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## II.—POLITICAL GEOGRAPHY.

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*To the Council of the Royal Geographical Society.*

GENTLEMEN,

WOMBWELL HALL, GRAVESEND,  
March 30th, 1877.

The number of candidates for the Prizes in Political Geography was twenty, coming from thirteen schools. In each of the two preceding years it was nineteen. In 1874 it was only twelve.

The successful competitors are :—

1. Gold Medal .. .. WILLIAM JOHN NEWTON, Liverpool College.
2. Bronze Medal .. .. JOHN WILKIE, Liverpool College.

### *Honourably Mentioned.*

ARTHUR REED ROPES, City of London School.  
WILLIAM WALLIS ORD, Dulwich College.  
SAMUEL FOWLER BLACKWELL, Clifton College.  
GEORGE ARNOLD TOMKINSON, Haileybury College.  
HENRY COLTHURST GODWIN, Clifton College.

The Gold Medallist competed last year for the same Prize, and was Honourably Mentioned. The Bronze Medallist carried off the Gold Medal for Physical Geography. Both, therefore, have already distinguished themselves, and the Papers of both on this occasion are of marked excellence.

They have run very close together. I have had to take considerable pains to ascertain their relative merit. In justice to Wilkie, I would mention that, out of twenty-one questions which both the candidates answered, he gained a majority of marks; but while he answered only one question which the other did not touch, Newton answered six which the former did not attempt, and among them were two of the most difficult, which Newton answered remarkably well. Both, however, acquitted themselves most creditably.

I would apply to both the language in which Professor Rupert Jones reported on Wilkie's Prize Paper last year: " Their Papers are clear, systematic, and comprehensive, showing a good general knowledge of " (on this occasion Political) " Geography, and a good special knowledge " of the subject of the Second Paper.

The first two of those Honourably Mentioned are nearly equal, and are sufficiently near to the Medallists to deserve special credit



for their work. The other three are also pretty equal to one another, but they follow the others at a wider distance.

Among the latter, one did not strictly comply with the conditions, as he failed to answer the required number of questions in one group; but it is deserving of notice that this new condition was complied with by all the other candidates whose Papers are entitled to Honourable Mention.

In passing the questions I was guided by the nature of those set on the last three occasions, and by opinions which I received of the characters of the answers given. But I am led by the results of the present Examination to the conclusion that, while the present conditions as regards the number of questions, and the time allowed for answering them, afford a good test of the scope and extent of the candidates' studies in Geography, they scarcely admit of their answering them with the desired precision; and the Examiner may sometimes find it difficult to distinguish between the efforts of an overpressed or hurried memory, and the random guesses of superficial or deficient knowledge.

Last year Sir Leopold McClintock reported that "it appears deserving of consideration whether fewer questions requiring more precise answers, or whether a little more time to answer them in, would not more satisfactorily test the knowledge of the candidates;" and in the preceding year your President, Sir Rutherford Alcock, stated that he "joined in the recommendation of his predecessor, Professor Rawlinson, as to the desirability of more exactness in the knowledge acquired, and the avoidance of any random use of figures." I do not think that the number of questions should be reduced, as they afford a good test of the scope of the candidates' reading, and give them a reasonable degree of selection; but the time might be enlarged, if more than one day could be given to the examination.

Perhaps the experience of some of the past Medallists might be advantageously consulted as to the means of more effectually testing the precision, as well as the general knowledge, of the candidates.

RAWSON W. RAWSON.

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## PROGRAMME FOR 1878.

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THE Council of the Society have satisfaction in repeating the offer of Prize Medals for the ensuing year; the Second Medal to be Silver, instead of Bronze as heretofore. They have invited the following Public Schools to take part in the competition:—

### *List of Schools invited to compete in 1878.*

*English Schools.*—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; High School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

*Channel Islands School.*—Victoria College, Jersey.

*Scotch Schools.*—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School; Glasgow Academy.

*Irish Schools.*—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College; Rathmines School, Dublin.

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### *Syllabus of Examinations for the Prize Medals of the ROYAL GEOGRAPHICAL SOCIETY in 1878.*

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#### EXAMINATION IN PHYSICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, according to printed regulations (which will be forwarded in due time), on the fourth Monday in March, 1878, and will consist of two papers of three hours each; the one to be answered between 9 and 12, 9½ and 12½, or 10 and 1 A.M. (according

to the convenience of the School); and the other between 2 and 5, 2½ and 5½, or 3 and 6 P.M.

N.B. It is necessary, in order that Candidates may be admitted to the Examination, that their names be sent in to the Secretary of the Society on or before the *first* Monday in March.

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*No. 1 Examination Paper* will consist of questions on the following subjects:—

A. *Configuration of the Earth*, as learnt by careful study of a globe. What are the distances, speaking roughly, between such remote places as may be specified? What places of importance lie on the direct lines between them, and what is the section along each? What are the relative size, elevation, &c., speaking roughly, of such well-known districts, mountains, and rivers, as may be specified?

B. *General Physical Geography*.—Distribution of land and sea, forests, plateaux, glaciers, volcanoes, man, animals, plants and minerals; climates and seasons; oceanic, meteorological and magnetic phenomena.

\* \* Extra marks will be allowed for sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy. Some of the questions will be framed so as to make illustrations by sketches obligatory.

The candidates may be required to construct a rough map without the aid of special instruments, from a brief description of a district illustrated by itineraries and bearings.

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*No. 2 Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1878 is—

THE BASIN OF THE NILE, AND THE PORTION OF AFRICA THAT LIES TO THE EAST OF IT.

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#### EXAMINATION IN POLITICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, at the same hours and under precisely the same regulations as those in Physical Geography.

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*No. 1 Examination Paper* will consist of questions on the following subjects :—

A. *Descriptive Geography*.—Explanation of latitude and longitude. What are the distances in geographical miles, speaking roughly, and as learnt by the careful study of a globe, between such remote places as may be specified? What places of importance lie on the direct line between them? What is the relative size, speaking roughly, of such well-known countries, mountains, and rivers, as may be specified?

B. *Historical Geography*.—Embracing (1) the boundaries of states and empires at different historical periods; (2) the chief lines of commerce, ancient and modern; (3) the influence of geographical features and conditions upon the distribution of races and political history of mankind.

\* \* Extra marks will be allowed for maps and sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy. Some of the questions will be framed so as to make illustrations by sketches obligatory.

The candidates may be required to construct a rough map without the aid of special instruments, from a brief description of a district illustrated by itineraries and bearings.

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*No. 2 Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1873 is—

THE BASIN OF THE NILE, AND THE PORTION OF AFRICA THAT LIES  
TO THE EAST OF IT.

*Candidates will be expected to be acquainted with the History of Geographical Discovery in the Nile Region.*

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The following books contain much information regarding the Physical and Historical Geography of the Nile Basin and Countries lying to the East of it :—

1. 'Herodotus,' Book II. Rawlinson's Edition. Vol. II. London : Murray.

2. 'Claudius Ptolemy and the Nile.' By W. D. Cooley. London : Parker and Son. 1854.

3. 'Handbook for Travellers in Egypt.' London: Murray.
4. 'Reisen in Nubien, Kordo'an,' &c. By E. Rüppell. 1829.
5. 'Travels in Nubia.' By J. L. Burckhardt. 1819.
6. 'Travels to Discover the Source of the Nile in 1768-1773.' By James Bruce.
7. 'The Nile Tributaries of Abyssinia.' By Sir S. W. Baker. London: Macmillan.
8. 'History of the Abyssinian Expedition.' By C. R. Markham. London: 1869.
9. 'The Heart of Africa.' By Dr. Schweinfurth. London, 1874.
10. 'Journal of the Discovery of the Source of the Nile.' By Captain J. H. Speke. 1863.
11. 'The Albert Nyanza, Great Basin of the Nile.' By Sir S. W. Baker. London: Macmillan.
12. 'Summary of Observations on the Geography, &c., of the Lake Region of Equatorial Africa.' By Colonel J. A. Grant. 'Journal' R. G. S., Vol. XLII.
13. 'Reise in das Gebiet des Weissen Nil.' By Th. von Heuglin. Leipzig, 1869.
14. 'Notes to accompany a Survey of the White Nile.' With Map. By Colonel C. G. Gordon. 'Journal' R. G. S., Vol. XLVI., p. 431.
15. 'Stanley's Exploration of the Victoria Nyanza.' By Colonel J. A. Grant. 'Journal' R. G. S., Vol. XLVI., p. 10.
16. 'Egypt, the Soudan, and Central Africa.' By J. Petherick. 1861.
17. 'Journey through the Afar Country.' Munzinger, 'Journal' R. G. S., Vol. XXXIX.
18. 'The Highlands of Ethiopia.' By Sir W. C. Harris. 3 Vols. London, 1844.
19. 'First Footsteps in East Africa; or, an Exploration of Harar.' By Captain R. F. Burton. London, 1856.
20. 'Reisen in Ost Africa.' By Baron C. C. von der Decken. Leipzig, 1869-70.
21. 'Geographical Notes of an Expedition to Mount Kilima-ndjaro.' By Baron C. C. von der Decken. 'Journal' R. G. S., Vol. XXXIV.
22. 'Travels, Researches, &c., in Eastern Africa.' By J. L. Krapf. London, 1860.
23. 'Life, Wanderings and Labours in East Africa.' By Rev. C. New. London, 1874.

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\* \* In accordance with a recent Minute of the Council, the Libraries of competing Schools can be furnished with the Volumes of the Society's 'Journal' at the rate of 15s. each for past, and 7s. 6d. for the present and future years.

# AFRICAN EXPLORATION FUND.

JULY 1877.

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PATRON, H.R.H. THE PRINCE OF WALES.

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DURING the month of June in the present year the following Circular was issued to all Fellows of the Society, and to others likely to sympathise with its objects. The motives which induced the Council to take the important step thus announced are set forth in the commencing paragraphs of the Minute, forming the Appendix to the Circular.

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## CIRCULAR

BY THE SPECIAL COMMITTEE APPOINTED BY THE COUNCIL  
OF THE ROYAL GEOGRAPHICAL SOCIETY TO ADMINISTER  
THE AFRICAN EXPLORATION FUND.

THE Council of the Royal Geographical Society have considered it a duty, on grounds fully explained in the Minute appended to this Circular, to take their appropriate part in the present great movement to lay open the whole interior of Africa to civilisation and European commerce.

They have accordingly appointed a Special Executive Committee, with authority to announce the formation of an African Exploration Fund, entirely separate from the general income of the Society, towards which they have contributed a first grant of 500*l.*, to initiate a national undertaking for the systematic and continuous exploration of Africa.

Geographical investigation is the only part of the larger scheme of civilisation that falls within the special field of the Royal Geographical Society; but being a preliminary step to ulterior ends, it commends itself to the sympathy of many who are not geographers. A vast waste of effort, life, and money will be avoided in the future prosecution of philanthropic and commercial opera-

tions in Africa, if the Physical and Political Geography of its interior be previously well determined. When the best routes have been clearly ascertained, we may hope that it will not be long before wagon roads—if not railways and telegraphic lines—will follow, tending gradually to the extinction of the slave-traffic, which now depopulates some of the richest and most productive territories to be found in any part of the world.

The attainment of adequate geographical knowledge is, however, a task of no ordinary magnitude and cost, and the requisite means, being far in excess of those now at the disposal of the Royal Geographical Society, cannot be obtained except through an appeal to the public.

The accompanying Sketch-Map\* has been designed to show at a glance, by the names inscribed on the routes traversing Africa in numerous directions, how large a portion of the great Continent, so far as priority of discovery is concerned, has been appropriated by British travellers. It is true they have not been alone in the great work; but the large share in the exploration of those parts of Africa to which public attention is now specially directed that may be claimed by Livingstone, Burton, Speke, Grant, Baker, Gordon, and lastly Cameron, all British subjects, will readily be traced. What these have so well begun, it is now desired to complete.

It must be borne in mind that steam navigation is bringing Eastern Africa into close communication with Europe. The mail services recently established, and likely to be further developed, touch at various ports in Eastern Africa, and cannot fail to stimulate European commerce with the interior, by affording increased facilities of intercourse.

A trade has existed since a very ancient period between the opposite shores of India and Africa; and it must be of importance that all hindrances to its increase should be removed. A great development of enterprise along the Eastern coast may also be expected on the side of our South African Colonies, if the productive regions of the interior be opened up. The proposed scientific exploration of the capabilities of Africa, and the discovery of the best means of reaching its interior from the Eastern coast, will be a most serviceable step in this direction.

In the appended programme of routes suggested for exploration or more careful examination, it is not to be assumed that the Committee bind themselves to these, as necessarily the best or the only ones to be adopted, even at the present moment. Before finally determining the details of any proposed Expedition, the Committee will make it a practice of seeking information from the principal

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\* Issued with the original Circular.

African geographers and travellers, many of whom are already Fellows of the Royal Geographical Society.

It is not proposed by the Committee to confine their operations to the furtherance of Expeditions under their entire control. They will be willing to consider the propriety of assigning a grant in aid to secure good geographical results from any Expedition, missionary or commercial. It will be their endeavour to collect and diffuse the latest geographical information; to procure its early discussion before the Royal Geographical Society; to point out the more immediate desiderata in African Geography; to prevent waste of effort in desultory or unimportant explorations; and to turn the large resources of the Society in books and instruments, and especially in the willing services of its Fellows who are authorities on African matters, to helpful account.

In such a work the Fellows of the Royal Geographical Society are sure to sympathise; and to them, in the first instance, as a large and influential body, the Committee would appeal, to further, by subscriptions or donations, no less than by their influence throughout the country, the objects contemplated.

The Committee are confident that the public generally will not be asked in vain for means to prosecute with vigour such explorations as may promote objects, which history shows to have enlisted on many occasions the warmest sympathy of the Nation.

They would say in conclusion that, in seeking to promote a national undertaking which may assume very large proportions, they propose to begin with such funds as they have in hand, and to persevere to the extent which these and further contributions will allow. The difficulties to be anticipated in efforts to civilise Africa must not be underrated, considering how large has been the proportion of unsuccessful attempts. But they feel convinced that persistent and simultaneous explorations from many sides, and of a scientific character, offer the best hope of ultimate success.

The object of the present Circular is to invite public attention to the subject, and to afford an opportunity to those who are already interested in African Exploration, or may from various considerations desire to promote its systematic prosecution, to come forward and give such pecuniary support to the Committee as will enable them to work with adequate means, and without interruption, until the necessary information is obtained.

RUTHERFORD ALCOCK, *Chairman.*

H. W. BATES, *Secretary to the Committee.*

1, Savile Row, London, W.

May 16, 1877.



*Routes in Eastern Africa that have been suggested for Exploration or careful Examination.*

- 1st. From the Gold Fields in South Africa, past the south end of Lake Tanganyika, to Unyanyembe.
- 2nd. Along the East face of the coast range, between the Zambesi and the Equator.
- 3rd. From the East coast to the north end of Lake Nyassa.
- 4th. Between the north end of Lake Nyassa and the south end of Lake Tanganyika.
- 5th. From the coast opposite Zanzibar to the south end of Lake Victoria; thence to the north end of Lake Tanganyika.
- 6th. From Mombasa, by Kilimandjaro, to the south-east shore of Lake Victoria.
- 7th. From Formosa Bay along the valley of the River Dana, by Mount Kenia, to the north-east short of Lake Victoria.

*No. 1 Route. Gold Fields to Unyanyembe.*—This route would cross the Zambesi above Tete, and would connect the furthest point reached by Baines ( $17\frac{1}{2}^{\circ}$  s. lat. and  $30\frac{1}{2}^{\circ}$  E. long.) with Livingstone's route in 1866-67. In its entire length it extends through twelve and half degrees of latitude, and it leads along the high land that separates the three lakes, Bangweolo, Nyassa, and Tanganyika; a healthy hilly country from 4000 to 6000 feet above the sea-level. It is of much consequence that the character of the people, and the products of the land, as well as the physical features of the whole of the country traversed by this route, should be fully ascertained. If all these prove to be favourable to the undertaking, a line of overland telegraph might be opened from Cape Town, through the Gold Fields to Unyanyembe, and thence in time to Egypt and Europe.

*No. 2 Route. Exploration of the Eastern face of the Coast Range.*—We only know this at intervals, where it has been crossed by a few travellers—mostly at the same "passes." The contours of the range should be explored either from the sea-face or from the plateau side, with the view, first, of determining the points where the range is nearest to the sea, as it is of material importance to get quickly away from the unhealthy coast to higher and consequently healthier regions; secondly, with the view of finding the most convenient lines of access to the interior.

*No. 3 Route. From the Eastern coast to the North end of Lake Nyassa.*—Portions of the district to be traversed by this route were visited by Dr. Roscher and Baron von der Decken, and more

recently by Bishop Steere. There appears to be a natural highway across it, through which slave-caravans have travelled for many years. A route from the East coast to the North end of Nyassa would be important as a main line, whence connections might hereafter be made with the South end of that lake, and with the South end of Lake Tanganyika.

*No. 4 Route. From the North end of Nyassa to the South end of Tanganyika.*—Livingstone crossed this route in 1872, but beyond this we are almost entirely ignorant of its nature. It would connect two great lakes, on one of which a Missionary Station is already established, and it would solve many vexed geographical questions, one of which is the real distance between the lakes. It would be important to learn the capabilities of the country for a wagon-road to connect Tanganyika with the anticipated trading depôt at the north end of Nyassa.

*No. 5 Route. From opposite Zanzibar to Lake Victoria and the North end of Tanganyika.*—The Church Missionary Society have established a station this year at M'papwa, 200 miles from the coast, and their parties for Karagwe and Uganda will probably be at their destinations by Midsummer. The experiences of the Rev. Roger Price, of the London Missionary Society, have shown that the tsetse fly did not injure cattle last year on the route to M'papwa; and Mr. Price reports so favourably upon the physical features of this portion of the country, that a large party are now being equipped with bullock-carts, in which they are to proceed to Ujiji. It is proposed, however, to explore a nearer way to Lake Victoria than that by M'papwa. The western third of the route, extending from the south point of Lake Victoria to the north end of Tanganyika, is as yet untraversed by Europeans, and lies across the high land that appears to divide the Nile from the Congo.

*No. 6 Route. From Mombasa, by Kilimandjaro to the South-east Shore of Lake Victoria.*—We know but little of this route through the travels, reports, and hearsay of Dr. Krapf, Baron von der Decken, and the Rev. Messrs. Wakefield and New, as none of these gentlemen have penetrated further than the snow-capped mountain Kilimandjaro (about 19,000 feet in height). It is a long-established caravan-route, and leads in a direct line to the south-east shore of Lake Victoria.

*No. 7 Route. From Formosa Bay, by the Dana River and Mount Kenia, to the North-east Shore of Lake Victoria.*—This route passes through a mountainous country, and may therefore be expected to be subject to no great heat or malaria, although it lies only 2°

south of the Equator. The district it traverses is certainly well watered, and is probably fertile. The late Captain Speke strongly recommended a route from east to west at  $1^{\circ}$  north of the Equator, but the one already mentioned is shorter, and has at least equal advantages. The River Dana has been found to be navigable for 100 miles, and might prove to be so for many more. Dr. Krapf reports that it was 7 feet deep at 50 miles to the east of Mount Kenia, but that it was rocky. It is said that the Samburo people, to the north, employ camels and horses; if this report be true, the explorer or trader would be independent of porters. This route has many recommendations: the famous Mount Kenia, capped like Kilimandjaro with snow, lies on the way, and the earlier portion of the journey might be made by water.

In addition to these specific lines of exploration, and in connection with a trunk-road across the Continent, efforts should be made to explore the great extent of unknown country to the north of the Lualaba, so as to connect Equatorial Africa with Darfur, with Lake Tchad, and with the valley of the Ogowé.

The Committee may also have to indicate to their travellers convenient places of rendezvous—such as Ujiji, on Lake Tanganyika, and Nyangwé, on the Lualaba, with others to be fixed hereafter—in the respective dominions of the Casembé, the Kassongo, and the Muata Yanvo. Nyangwé, as being at present the most advanced post of African exploration, is especially important as a dépôt.

Other measures might be suggested to be carried out when favourable opportunities should occur, such as to place a steamer on the Congo above the falls, for purely exploratory purposes.

A comparison has been made of the length of each journey in Africa, in a few recent instances, with the cost of making it. It appears that the total expense of despatching a well-equipped exploratory Expedition from England may be roughly reckoned at the rate of 1*l.* 10*s.* for each geographical mile of country travelled over in Africa, supposing the Expedition to return to the place whence it set out. In through journeys, the rate is, in many cases, nearly twice as great. The aggregate length of the seven specified routes is about 7700 geographical miles; consequently, the total cost of the proposed Explorations, at the above rate, would amount to about 11,550*l.* It is needless to dwell on the fact that this is an exceedingly rough estimate; nevertheless, it serves to give some useful idea of the expense contemplated. The annexed Table enters more into detail:—

ROUTE.	Approximate Distance in Geographical Miles.	Cost, if reckoned at £1 10s. per Mile.
1. Goldfields to Unyanyembe, and back ..	2000	£ 3000
2. East Coast Range, Zambesi to Equator* ..	1400	2100
3. East Coast to North of Nyassa and back ..	500	750
4. North of Nyassa to Tanganyika, and back†	400	600
5. Zanzibar to Lake Victoria and Tangan- yika, and back .. .. . }	1600	2400
6. Mombasa by Kilimandjaro to Lake Vic- toria, and back .. .. . }	900	1350
7. Formosa Bay by Kenia to Lake Victoria, and back .. .. . }	900	1350
	7700	£11,550

\* This is a through route, but its cost is estimated at a single rate.

† If conducted independently from Lake Nyassa, and not in connection with Route 4, the cost would be increased.

## APPENDIX.

MINUTE OF COUNCIL, *March 12th, 1877.*

1. THE Council of the Royal Geographical Society, being of opinion that the time has arrived when it becomes their duty to organise means for the systematic and continuous exploration of Africa, and recognising with sympathy and admiration the enlightened efforts of the King of the Belgians to give a new impulse to such exploration;—desiring, moreover, that the work it is proposed to carry out should be in harmony with the views of His Majesty, and of societies established in other countries for the purpose of exploration and new discovery,—resolve to spare no efforts to endeavour, by friendly interchange of information and assistance, to combine the energies and sympathies of all the civilised nations of the world in furtherance of the object which the King and the Geographical Society alike are desirous of promoting.

2. Looking, however, at the subject from a practical point of view, the Council of the Geographical Society are of opinion that

African Exploration will be more effectually prosecuted by England, and the necessary funds more readily obtained, through national enterprise than by international association.

3. The Council, therefore, in view of these considerations, propose, as the best course of action for the Royal Geographical Society, to assist in the establishing of a national fund, to be called the "African Exploration Fund."

4. The fund to be appropriated to the scientific examination of Africa (especially the central part of that continent) in a systematic and organised manner, with a view to the exploration of the regions yet unknown to civilised Europe, the attainment of accurate information as to climate, the physical features and resources of the country, the character of the inhabitants, the best routes of access, and all such other matters as may be instrumental in preparing the way for opening up Africa by peaceful means.

5. The Council propose that the African Exploration Fund should be kept entirely separate from the general income of the Society, and that the contributions annually made by the Society itself should from time to time be carried over to the account of the Fund. To secure the appropriation of the Fund to the special objects for which it is raised, the Council of the Geographical Society will name out of their body a Special Executive Committee, whose duty it will be, subject to the control of the Council, to see that the explorations set on foot are conducted in such a systematic manner as to prevent a wasteful expenditure of money or energy in repeating the investigation of places or subjects which have already been sufficiently investigated by British or foreign explorers, or in undertaking expeditions which other Societies may have already projected and be prepared to carry out in a satisfactory manner.

6. The Executive Committee will have authority to announce the formation of an African Exploration Fund, with the above-named objects; invite the support and co-operation of the public, and of any branch associations or committees already formed, or which may hereafter be constituted, in the United Kingdom or the Colonies, and generally to take such steps as may seem necessary for promoting the establishment of the African Exploration Fund and carrying into effect its objects.

7. Subject to the confirmation of the Council of the Geographical Society, and to any special rules for their guidance that may from time to time be laid down, the Committee will make regulations for the conduct of their proceedings, and generally in relation to any other matter which may be required to be provided for the establishment of the African Exploration Fund and the carrying

its objects into effect, provided the regulations so made are not inconsistent with the above-mentioned provisions.

8. The Council of the Royal Geographical Society will from time to time, and at least once in each year, summon a meeting of the subscribers to the Fund, for the purpose of explaining the progress made in exploration, the mode in which the Exploration Fund is being dealt with, and ascertaining, as far as practicable, the views of the subscribers in relation to such Fund.

9. The subscribers of one pound and upwards will be entitled to receive copies of any reports or proceedings published by the Committee. The Royal Geographical Society retain the right of priority of publication of any maps, geographical reports, or other similar information furnished by explorers supported by the Fund, but copies of such published reports will be sent in exchange to all national and local societies, whether British or foreign, constituted for the objects of the African Exploration Fund.

10. The Treasurer and Bankers of the Royal Geographical Society will act on behalf of the African Exploration Fund, opening a separate account under that head.

11. H.R.H. the Prince of Wales has, at the request of the Council of the Royal Geographical Society, signified his pleasure that he will allow his name to be associated with, and accept the office of Patron of, the African Exploration Fund.

12. The following Members are nominated as constituting the Executive Committee of the African Exploration Fund :—

The PRESIDENT of the SOCIETY for the time being,

Sir HARRY C. VERNEY, Bart.,

Sir C. FOWELL BUNTON, Bart.,

Sir RAWSON W. RAWSON, K.C.M.G., C.B.

Colonel J. A. GRANT, C.B., F.R.S.,

General C. P. RIGBY,

FRANCIS GALTON, Esq., F.R.S.,

and the *ex-officio* Members of the Committees.

13. The sum of 500*l.* will be carried over from the funds of the Society to the separate account of the African Exploration Fund.

*Donations and Annual Subscriptions to be paid to the Chief Clerk of THE ROYAL GEOGRAPHICAL SOCIETY, 1, Savile Row, W., or to Messrs. COCKS, BIRDOLPH, & Co, 43, Charing Cross, London, S.W., to the Credit of the AFRICAN EXPLORATION FUND. The Subscription List will be printed hereafter on a detached flyleaf.*

The fresh impulse to African Exploration stated in the foregoing Circular as forming the ground for the establishment of the African Exploration Fund, originated in the Conference at Brussels on the 12th, 13th, and 14th of September last, to which His Majesty the King of the Belgians invited a number of the leading geographers of the chief nations of Europe. Representatives from Germany, Austro-Hungary, Belgium, France, Great Britain, Italy, and Russia were present at the Conference, and, as a result of their deliberations, it was agreed that an International Commission, having its seat at Brussels, should be founded for the exploration and civilisation of Central Africa, and that each nation willing to co-operate should form national Committees to collect subscriptions for the common object, and send delegates to the Commission; thus centralising as much as possible the efforts made, and facilitating by co-operation the execution of the resolutions of the Commission.

Belgium was the first to establish a National Committee, the members of which assembled under the Presidency of the King on the 6th of November, 1876. At this meeting the statutes were formulated and agreed to, the preamble of which set forth that the Committee was constituted for the purpose of carrying into effect, within the limits of Belgium, the programme of the International Conference, which was stated to be the "repression of the slave-trade and the exploration of Africa." The Committee made an appeal to the Belgian public for subscriptions, with considerable success.

In England, when the organisation of a similar Committee came to be discussed, difficulties of an obvious nature were foreseen, which rendered it desirable that such a Committee, whilst maintaining friendly relations of correspondence with the Belgian and other Committees, should not trammel itself with engagements of an International nature, or with objects other than those connected with Geography. The constitution and programme of the Committee was thereupon arranged, as set forth in the foregoing Circular. In consequence of this decision, delegates have not been appointed to the International Commission at Brussels.

*Germany.*—In response to the views of the Brussels International Conference, a National Committee was formed at Berlin who decreed on the 18th of December, 1876, the establishment of the GERMAN AFRICAN SOCIETY, the functions of which will be to carry out the same objects as the International Commission, viz., 1. The Scientific Exploration of the unknown regions of Central Africa; 2, the opening up of Central Africa to civilisation and commerce; and 3, as ulterior object, the extinction of the slave-trade. The

affairs of the Society are to be administered by a Council, of which Prince Henry VII. Reuss is the President, Dr. George von Bunsen the Secretary, and Dr. Nachtigal, Herr Delbrück, Dr. A. Bastian, Dr. Herzog, Baron von Richthofen, Dr. Roth, and Dr. W. Siemens, the members. The Society will maintain relations with the International Commission at Brussels, and have appointed Dr. Bastian, Dr. G. von Bunsen, and Baron von Richthofen as German Delegates.

The Society is to consist of Founders and Members, the former comprising those who contribute a donation of 300 marks to its funds, the latter to include all annual subscribers of 5 marks and upwards—all corporations, chambers, and Scientific Societies to be admissible in their corporate capacities as members, on payment of proportionate subscription.

As to the disposal of the Funds accumulated by the Society, it has been decided that only a portion of the yearly income shall be contributed to the International Commission, the remainder and greater part being set apart for German undertakings of Discovery and Exploration in Africa. Like the Belgian Commission, a leading feature of the German operations will be the foundation of stations in the interior of Africa, which are to serve partly as bases of operations for travellers, and partly as centres for the spread of civilisation and commerce.

*Belgium.*—The “International Commission of the African Association” met, on the invitation of the King of the Belgians, at Brussels on the 20th and 21st of June last; His Majesty presiding. Delegates from all the nations represented at the Conference of September 1876 attended, with the exception of Great Britain and Russia, the National Russian Committee excusing the absence of their delegates on the ground of their being much occupied with work entrusted to them by their Government. Delegates from the Netherlands attended the Meeting for the first time. Various subjects of detail were discussed during the two days’ sittings; amongst them the choice of a flag for the Association, and the question of procuring reductions of passage money, and so forth, in favour of Members of Expeditions, from the various steamboat and trading companies connected with African seaports. With regard to this latter subject, it was announced by Signor Adamoli (Italian Delegate), that the Italian Government had made it a stipulation in its contracts with Navigation Companies that passages at a reduced rate shall be granted to all Members of Scientific Expeditions. A Netherlands delegate (M. Versteeg), also announced that the Directors of the *Afrikaansche Handels vereeniging*



*te Rotterdam* had agreed to convey baggage intended for the various Expeditions free of charge, and to grant hospitality in their factories to the Members of the Expeditions.

A statement of the Financial position of the Association at this date was read by the Secretary, by which it appeared that the Belgium National Committee had already paid over to the Central Commission 287,000 francs in donations, and 44,000 francs in annual subscriptions, totals which the Committee has promised to increase during the current year by 11,000 francs and 58,000 francs respectively. The donations and a portion of the annual subscriptions are to be invested and the interest only expended in the objects of the Association ; in this way, according to the calculation of the Treasurer, 73,000 francs will be at the disposition of the Executive Committee for the year 1877. The immediate commencement of operations has accordingly been decided upon ; and an Expedition is to be despatched by way of Zanzibar towards Lake Tanganyika, with the object of establishing stations either at the Lake itself, or at certain points beyond it ; and also of sending Explorers who will make these stations their basis of operations. The drawing-up of detailed instructions is confided to the Executive Committee appointed to direct the operations of the Association.

*Other Countries.*—National Committees to co-operate with the Belgian International Commission are stated to have been formed also in FRANCE, President, Count de Lesseps ; AUSTRO-HUNGARY, President, the Archduke Rudolph ; ITALY, President, the Prince de Piedmont ; SPAIN, President, the King ; SWITZERLAND, President, M. Bonthelie de Beaumont ; RUSSIA, President, the Grand Duke Constantine ; HOLLAND, President, the Prince of Orange ; and PORTUGAL, President, the Duke de San Januario.

The Austro-Hungarian Committee has made a first contribution to the funds of the Brussels Commission of 5000 francs.

# PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED JULY 23RD, 1877.]

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## SESSION 1876-7.

*Twelfth Meeting (ANNIVERSARY), May 28, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

THE proceedings commenced by the Secretary (MR. C. R. MARKHAM) reading the Regulations which govern the Anniversary Meetings, and the Minutes of the Meeting of 1876.

The following new Members were elected :—*Rev. Sir Talbot Hastings Bendall, Bart. ; Rev. George Brown ; Walter Coates, Esq. ; Frederick J. Dean, Esq. ; Charles Edward Hamilton, Esq. ; William Arthur Harrison, Esq. ; J. Newby Hetherington, Esq. ; William Grey E. Macartney, Esq. ; Henry Turton Norton, Esq. ; General John Meredith Read ; Robert Stewart, Esq. ; John Lloyd Wynne, Esq.*

Captain TOYNBEE and Professor TENNANT were then appointed scrutineers of the Ballot.

The Report of the Council was next read by the Secretary, after which followed the

## PRESENTATION OF THE ROYAL AND OTHER AWARDS.

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### ROYAL MEDALS.

THE FOUNDER'S MEDAL was awarded to Captain SIR GEORGE S. NARES, R.N., K.C.B., for having commanded the Arctic Expedition of 1875-6, during which the ships and sledge-parties respectively reached a higher Northern latitude than had previously been attained, and a survey was accomplished of 300 miles of coast-line, facing a previously unknown Polar Sea ; also for his Geographical services in command of the *Challenger* Expedition. The VICTORIA or PATRON'S MEDAL to the Pundit Nain Singh, for his great journeys and

Surveys in Tibet and along the Upper Brahmaputra, during which he has determined the position of Lhása, and added largely to our positive knowledge of the map of Asia.

Addressing first Captain Sir George Nares, the PRESIDENT spoke as follows:—

“SIR GEORGE NARES,

“In delivering to you the Founder’s Medal of the Royal Geographical Society, the highest honour it is in their power to bestow, I am discharging one of the most agreeable duties of the President of this Society. I will only add that its primary object, which is to encourage Geographical Science and Discovery, does not exclude a just appreciation of the many high qualities displayed in your conduct of the Arctic Expedition, and without which the results attained could never have been secured. The discoveries which you, and the officers and men under your command, made of advanced Polar lands, were due to the energy, perseverance and endurance manifested by all, under hardships and difficulties of the gravest character. But especially do the records now before the world show the bold and skilful manner in which the ships of the Expedition were conducted, the leading vessel to the highest latitude yet attained, and probably possible of attainment by keel, and their safe return home from the hazards of ice-navigation of no ordinary character, even for Arctic Seas, with all appliances intact, and without accident to vessels or crews.

“With regard to the additions to our Geographical knowledge made by you, they cannot be better described than in the official language of the Lords Commissioners of the Admiralty when conveying their approval to you of the conduct of all engaged in the important service, which is as follows:—

“‘Notwithstanding, however, that it was found impossible for the sledging parties to attain a much higher latitude than that reached by Sir Edward Parry, the addition to geographical knowledge has been considerable. The conjectural open sea to the north of Smith Sound, and the land assumed to be there, have been proved not to exist. The coast line of the northernmost land yet known, adjoining the American continent, has been accurately charted for 220 miles. The north coast of Greenland has been examined for 80 miles, and traced as far as Cape Britannia in lat.  $82^{\circ} 54' N.$ , long.  $48^{\circ} 38' W.$  The western shores of Smith’s Sound have been corrected in detail; and, lastly, the question of the possibility of reaching the Pole by way of Smith Sound has been set at rest, whilst a higher latitude than any hitherto attained, viz.  $83^{\circ} 20' 26''$ , has been reached.’ ”

SIR GEORGE NARES replied :—

“MR. PRESIDENT and Gentlemen:—It is with much pride that I receive this gift, and I accept it as a token that the work I have performed has obtained the approval of so distinguished and leading a body as the Royal Geographical Society. The bestowal of such a highly wished-for honour is of itself one of the highest rewards I could possibly ever have foreseen for my work, and it entails considerable responsibility for the future; for if, hitherto, I have done my utmost to advance our knowledge of the Globe we inhabit, so, hereafter, it will be my endeavour to bear worthily the very high distinction which has now been conferred upon me.”

Colonel H. Yule, C.B., then came forward to receive the Medal on behalf of the Pundit Nain Singh. The PRESIDENT addressed him as follows:—

“Colonel YULE,

“Since Nain Singh’s absence from this country precludes my having the pleasure of handing to him in person, this, the Victoria or Patron’s Medal, which has been awarded to him for his great journeys and surveys in Tibet and along the Upper Brahmaputra, during which he determined the positions of Lhása, and added largely to our positive knowledge of the map of Asia, I beg to place it in your charge for transmission to the Pundit.

“I will myself address a letter to the Viceroy in India calling his attention to this award of one of the two Medals of the year, the highest honour this Society can confer on any Geographer, however distinguished by his services to Geographical Science or Discovery, and with a request that His Excellency will take such steps as he may deem best for its presentation to Nain Singh.

“But, in the mean time, I would beg you, who were the first to propose that this Medal should be so conferred, and took such generous and earnest interest in the recognition by the Society of Nain Singh’s high claims to that distinction, to convey to him from me, as the President of the Royal Geographical Society, the satisfaction the Council have felt in thus publicly marking their high appreciation of the noble qualities of loyalty, courage and endurance, by the display of which in no ordinary degree he achieved success, and was enabled to add so largely to our knowledge of that portion of Asia which no European could explore. I would ask you also to add that the Council have not failed to see that he has not worked as a mere topographical automaton; and were perfectly aware that, notwithstanding he was a native of Asia and familiar with Tibetan dialects, his journeys were not

accomplished without great peril to life. I would finally wish you to convey to Nain Singh, who in the performance of these distinguished services has suffered seriously in health by the extreme hardships attending his journeys, that I trust this public recognition of his merits as a Geographer from the Royal Geographical Society, which in its awards knows no distinction of nationality, race or creed, will be a source of satisfaction to him in his retirement, of which nothing can ever deprive him, to the end of a life he has devoted so faithfully to the public service and the advancement of Geographical knowledge."

Colonel YULE, in reply, said :—"I was taken by surprise when I was asked to officiate on this occasion as the recipient of the Medal for Nain Singh. The man who, beyond all others, ought to have occupied the position is Colonel Montgomerie, and I am sure that nothing but ill-health could have caused that gentleman to be absent on an occasion so interesting to him. Not only had Colonel Montgomerie given Nain Singh the most essential part of his training, but he was himself one of the most distinguished Himalayan explorers and surveyors, and had spent a considerable portion of his life at an altitude of 18,000 feet above the sea. I am utterly unknown to Nain Singh, and I shall therefore, by the leave of the Society, communicate the intimation of his having been assigned the Medal through Colonel Montgomerie. But though I do not know Nain Singh personally, I know his work, and can affirm that what the President has said about him is very just. He is not a topographical automaton, or merely one of a great multitude of native employés with an average qualification. His observations have added a larger amount of important knowledge to the map of Asia than those of any other living man, and his journals form an exceedingly interesting book of travels. It will afford me great pleasure to take steps for the transmission of the Medal through an official channel to the Pundit."

A Gold Watch, with an appropriate Inscription, was also presented to Captain A. H. Markham, R.N., for having commanded the Northern Division of sledges in the Arctic Expedition of 1875-6, and for having planted the Union Jack in 83° 20' 26" N., a higher latitude than had ever before been reached by any previous Expedition.

In delivering the Watch, the PRESIDENT said :—

"Captain MARKHAM, I have much pleasure in presenting to you, in the name of the Royal Geographical Society, this Watch, in public recognition of their appreciation of the valuable services you rendered in command of the Northern Division of Sledges in the Arctic Expedition of 1875-6, in the course of which you reached

the latitude of  $83^{\circ} 20' 26''$  N., the highest that had been attained by any previous Expedition."

Captain MARKHAM replied:—

"Mr. President and Gentlemen:—I have to express my grateful thanks for the high honour conferred upon me. Though I have been selected as the recipient of the more substantial part of the honour, I know it will be felt and appreciated by my companions, without whom I should not have been placed in the position I now occupy. I cannot help thinking also, that apart from my having planted the Union Jack in the highest Northern latitude yet reached, I have been selected for this honour because I was the senior officer of the extended sledging parties of the Expedition, and that it is an acknowledgment on the part of the Royal Geographical Society of the geographical services which those parties rendered."

#### PUBLIC SCHOOLS' PRIZE MEDALS.\*

The following was the award of the Examiners for the present year:—

PHYSICAL GEOGRAPHY. *Gold Medal*.—Walter New, Dulwich College. *Bronze Medal*.—Arthur Smyth Flower, Winchester College. *Honourably Mentioned*.—John Chisman, City of London School; J. A. Robinson, Liverpool College; Frank Stanton Carey, Bristol Grammar School.

POLITICAL GEOGRAPHY. *Gold Medal*.—William John Newton, Liverpool College. *Bronze Medal*.—John Wilkie, Liverpool College. *Honourably Mentioned*.—Arthur Reed Ropes, City of London School; William Wallis Ord, Dulwich College; Samuel Fowler Blackwell, Clifton College; George Arnold Tomkinson, Haileybury College; Henry Colthurst Godwin, Clifton College.

Mr. FRANCIS GALTON said it gave him much pleasure, on this as on many previous occasions, to be able to assure the Society of the public appreciation of the Examinations. Nearly all of the more important schools had at one time or another sent candidates. Eton had won no less than 5 out of the 36 Medals that had hitherto been adjudged, and 11 other schools had each contributed one or more names to the list of Medallists. There were at present only two important schools which had never sent a candidate, Harrow and Rugby. Many testimonies had been borne to the

\* The Medals offered by the Society for Geography, through the OXFORD AND CAMBRIDGE LOCAL EXAMINATIONS, were awarded for the year 1876, as follows:—OXFORD (June), *Silver Medal*, John Wilkie, Liverpool College. *Bronze Medal*.—Herbert Marlow Waid, Bridgnorth Grammar School (both for General Geography). CAMBRIDGE (December), *Silver Medal* (Physical Geography), *Silver Medal* (Political Geography), both to H. C. Temple, Brighton Grammar School.

great service rendered to the cause of Education by these prizes. In a communication to the Conference of Head Masters held last Christmas, the Rev. George Butler, the Principal of Liverpool College, said he was grateful for the stimulus they afforded to the masters and boys, for the books that were suggested in the yearly programmes, and for the appointment of Examiners who had special knowledge of the country whose geography was the subject for the year. Invitations to compete were sent to 51 schools. Of these 17 responded, sending 22 competitors in Physical Geography, and 20 in Political Geography. The Medallists were reported by the Examiners to fully deserve their respective honours, and those who had received Honourable Mention, to be well entitled to that distinction. It had always been hoped that some of the very ablest youths at the schools would be induced to take an interest in Geography, and there was one remarkable proof that this had been accomplished, for Mr. McAlister, the Senior Wrangler of Cambridge this year, won the Gold Medal for Physical Geography in 1871. He (Mr. Galton) wrote to ask his candid opinion whether the time he had spent on Geography, in preparing to compete for the Medals, had on the whole been a help, a hindrance, or of no effect, in his academical career. His reply was full of gratitude for the benefits he received from that source, and his allegiance was still strong to the Society for the encouragement they had given him by their award.

Mr. F. Galton then introduced Mr. WALTER NEW, of Dulwich College, to receive the Gold Medal for Physical Geography, stating that he ranked decidedly first among the candidates. Last year he obtained the Bronze Medal, and this year the general style of his answers was such as would have done credit to a mature scholar.

The PRESIDENT, in presenting the Medal, said he was glad to find that the promise given by Mr. New in 1876 had been so richly and amply fulfilled.

Mr. F. GALTON said, before introducing the next in order of merit who was to receive the Bronze Medal, he wished to recall the memory and service formerly rendered to the Society by Admiral Smyth, who died twelve years ago, full of years and scientific honour, and to whom was due just one-half of the credit of the foundation of the Society, which was established by the combination of two contemporary and independent schemes, of one of which Admiral Smyth was the sole originator. It was he who revived the declining fortunes of the Society in 1849, when its numbers were diminishing, its expenses exceeding its income, and it was doubtful whether it would not entirely collapse. In that crisis, Admiral Smyth was elected President, and, under his sagacious and energetic guidance,

new life was infused into the decaying Society; its influence made itself more widely felt, its numbers rapidly increased, and its resources were established on a firm footing. According to the reiterated expression of Sir Roderick Murchison, who was his immediate successor in the Chair, it was to Admiral Smyth that the first step was due that led to its present prosperous condition. The Bronze Medallist, Arthur Smyth Flower, of Winchester College, was the grandson of Admiral Smyth.

The PRESIDENT, in presenting the Medal, said it was peculiarly gratifying to him to do so; and he was quite certain that the manner in which the questions had been answered was merely an indication of what Mr. Smyth Flower would do thereafter.

Sir RAWSON W. RAWSON, as the Examiner in Political Geography, said he was very much disappointed that he had not the opportunity of introducing the two boys who had gained the Medals for Political Geography, more especially as the Bronze Medallist, John Wilkie, gained the Gold Medal last year for Physical Geography, and ran his competitor so close this year, that the papers had to be looked through twice, before it could be decided which was the best. He had heard that, if it had not been for the boy's attention having been devoted to other examinations, it was very likely that he would have won the Gold Medal. At the same time it enhanced the merit of the Gold Medallist, that he was a year younger than Wilkie. They were both from the same school, Liverpool College. Both the papers were excellent.

The PRESIDENT handed the Medals to Sir Rawson W. Rawson for transmission to the recipients.

The Hon. G. C. BRODRICK, in announcing the next year's subject as "The Nile Basin, and that part of Africa which lies to the East of it," said this might be called the classic region of Africa: for it was the oldest, as it certainly was the most recent, field of African geographical discovery. It possessed a special interest at present, because if the great scheme for the systematic exploration of Africa now in contemplation should be carried out, it was certain that one, if not more routes to be selected, would pass across that very region. So that in this case, as in the last two years, the candidates for the prizes would have the satisfaction of feeling that they were following in the footsteps of travellers who were actually engaged in making Geography. He was quite sure that by thus connecting geographical education with geographical exploration, the Society was rendering good service to both, and also promoting the interests of general education.



## ALTERATION OF THE REGULATIONS.

Sir RAWSON W. RAWSON rose to propose the amended Rules, of which notice had been given, as having been agreed upon by the Joint Committee appointed by the Special General Meeting of March 5th. He said the Council felt there was a great difficulty to be dealt with, and that the problem of satisfying all the requirements of the Extraordinary Meetings was rather beyond them; they were, therefore, happy when the Joint Committee, appointed by the General Meeting, took the responsibility off their hands, and it was very satisfactory to be able to state that the Committee had been unanimous as to the recommendations to which they had agreed.

The Motion was that the Rules under Chapter V. of Section 3 of the Regulations be repealed, and the following enacted in their place:—

## SECTION 3, CHAPTER V.

1.—The Ordinary Meetings shall be held on the Evenings of the Second and Fourth Monday of every month during the Session; or oftener, if judged expedient by the Council. The Chair shall be taken precisely at Half-past Eight o'clock.

2.—Fellows will be admitted to the Meetings, on showing their "Fellow's Ticket," which will be sent to all whose Subscriptions are not in arrear, at the commencement of each Session.

3.—Visitors, if introduced *personally* by Fellows, or by a Fellow's Ticket transferred for the occasion, may be present at the Meetings; such privilege of introduction being limited to *one* Visitor only for each Fellow.

4.—At the Ordinary Meetings, the Order of Proceeding shall be as follows:—

- A. The Minutes of the last Meeting to be read, and, if their accuracy be not questioned by the Meeting, to be signed by the President or Chairman.
- B. The Presents made to the Society since their last Meeting to be announced, and thanks ordered to be returned.
- C. New Fellows to be introduced to the President or Chairman; result of Ballot of Candidates to be announced, and recommendations of other Candidates to be read.
- D. Papers and Communications to be read and discussed.

5.—At the Ordinary Meetings of the Society nothing relating to its regulations or management shall be brought forward. But the Minute-Book of the Council shall be on the Table at each Meeting, and extracts therefrom may be read to the Meeting on the requisition of any Fellow.

6.—On occasions of exceptional interest, to be notified by the President at the preceding Meeting of the Society and duly advertised in the Daily Newspapers, ordinary Tickets will not be available; but applications from Fellows

will be received at the Office of the Society for Orders of Admission for themselves and their friends, the number of Visitors to be restricted to one for each Fellow. Such applicants shall, in the order in which they apply, after the above notification, receive orders of admission for themselves and their friends to the seats set apart by the Council, for Fellows and their friends.

7.—On such occasions as described in Rule 6, Eighty Seats shall be reserved for Members of Council and their friends; and Fifty Reserved Seats for Visitors of distinction shall be at the disposal of the President.

Sir MORDAUNT WELLS said he had great pleasure in seconding the Motion to adopt the Report of the Committee. The Committee had come to a unanimous decision to abolish the blue ticket-books, which had been the chief cause of the evils which had been so much complained of, and the result would be, not to curtail the privileges of the Fellows in any way, for they would be allowed to introduce each a friend personally, and, if unable themselves to attend, to transfer their tickets to a member of their family, or any other person. He thought it most desirable, even with reference to the Ordinary Meetings, that this change should take place. Although the new Rules might not insure everything that might be desired, the Members might rest assured that the scenes which had taken place on previous occasions would never occur again. The Members of the Committee appointed by the Council were most anxious and willing to do everything they possibly could to meet the difficulties; and the fact that the Committee had come to a unanimous conclusion was to him, personally, a justification for the trouble he had given in endeavouring to bring about an alteration in the Rules. He felt that the action of the Committee had brought the great body of the Fellows into strict harmony with the Council, whom they so much respected.

Mr. ANDERSON wished to know whether the tickets issued to the Fellows for themselves and their friends on extraordinary occasions would be numbered in the order in which the applications were made, and would represent numbered seats in St. James's Hall?

Mr. JEFFS asked if the number of tickets issued would be limited to the number of seats?

The PRESIDENT, in reply, said what was contemplated by the Committee was that tickets should be issued representing the number of seats available, and those who applied for tickets after that number had been issued would be told that there was no more accommodation.

Mr. WILLIAM MORRIS JAMES said that as any arrangement which excluded Fellows from these Extraordinary Meetings was inadvisable, he would, without any desire to be in opposition to the

Council, propose the following amendment, "That the proposed new Rules should be referred back to the Council for consideration."

Dr. A. BUCHANAN seconded the amendment, and was supported by Dr. Glen, who thought that the existing Rules would work satisfactorily if they were really carried out.

Sir MORDAUNT WELLS said no one had been more anxious than himself to maintain the rights of the Fellows; but if the views expressed by the mover of the amendment were approved of, the result would be to exclude strangers altogether from these Meetings.

Lord HOUGHTON having appealed to the Members to give the proposed new Rules a fair trial, and an amendment proposed by Mr. ARTHUR to the effect "that those Members at Extraordinary Meetings, who might fail to obtain special tickets, should be admitted after the Chair had been taken, on production of their ordinary tickets," having fallen through for want of a seconder,

Mr. WILLIAM MORRIS JAMES' amendment was put, and negatived by a considerable majority of the Meeting.

The PRESIDENT then put the original motion "That the new Rules be adopted," which was carried.

Lord COTTELOE then moved that the words "or as near the date as may be found convenient" should be added to the present Rule I., Chap. V., Section 1.

The Motion was seconded by Sir HENRY RAWLINSON, and carried without opposition.

A vote of thanks was then moved by Mr. ANDERSON to Sir Mordaunt Wells, and the Committee that assisted him, for the Resolutions at which they arrived.

Professor TENNANT seconded the Motion, which was agreed to.

The Scrutineers then announced the result of the Ballot, the Council's list being declared duly elected.

The PRESIDENT then read the Annual Address on the Progress of Geography.

On its conclusion Mr. F. GALTON proposed a vote of thanks to the President for his excellent Address. The Fellows were greatly indebted to Sir Rutherford Alcock for the public spirit he had shown in conducting the affairs of the Society.

General SIRACHEY seconded the Motion, which was agreed to.

On the motion of Professor TENNANT, a vote of thanks was accorded to the retiring Members of Council, and the Meeting then terminated.

# ADDRESS

TO

## THE ROYAL GEOGRAPHICAL SOCIETY.

*Delivered at the Anniversary Meeting on the 28th May, 1877.*

BY SIR RUTHERFORD ALCOCK, K.C.B., D.C.L., PRESIDENT.

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GENTLEMEN,

THE period which has elapsed since the last Anniversary Meeting of the Royal Geographical Society has been an unusually eventful one in many respects. The return of the Arctic Expedition, quickly following that of the *Challenger*, and of Cameron from his marvellous journey across Central Africa, excited great interest in researches prosecuted in such widely-separated and diversified fields of Geographical discovery. The continued discussion of the various conditions of success, and the scientific results of Arctic exploration, as also the Meeting of the African Geographical Conference in Brussels last autumn, at the invitation of the King of the Belgians, are evidences of active interest which cannot fail to bear fruit at no distant period, and to promote the cultivation of Geography as a science in all its branches.

It has been the endeavour of the Council and myself, during the past year, to effect some of the objects glanced at in the last Anniversary Address of my predecessor, Sir Henry Rawlinson, as being then under consideration. I allude more particularly to the desire to extend in a more strictly scientific direction the range of the Geographical Society's work and influence. In pursuance of the plan sketched out in my opening Address, two out of three Lectures arranged for this Session, on Physical Geography in its higher and more scientific aspects, have been already delivered; the first by General Strachey, being an "Introductory Lecture on Scientific Geography;" and the second by Dr. Carpenter on "The Tem-

perature of the Deep-sea Bottom, and the Conditions by which it is determined."

The names of both these gentlemen would be a sufficient guarantee of the excellence of their work, and its adaptation to the end in view. I may, however, be permitted to say that nothing could in my opinion have better realised the intentions of the Council, or better served the interests of Geographical Science, taken in its largest sense, than the admirable Lecture we listened to from General Strachey. The outline it supplied of the principal scientific aspects of Geography, in relation to its past history, and to the influences of Geographical conditions on the human race, left nothing to be desired. The principal matters that fall within the range of Scientific Geography were all succinctly traced in their natural order and connection: and with such clearness of exposition and arrangement, that the most recondite facts and principles lost much of their unattractiveness to the uninitiated.

So, in like manner, I may say that Dr. Carpenter's review of some of the more striking influences of the temperature of the Deep-sea Bottom, and the conditions by which it is determined, well illustrated the utility of not limiting our view of physical changes to the surface of the earth, or the more obvious forces in operation upon either the land or water. We were shown that, while exploring the bottom of the great ocean-beds, we were dealing with at least two-thirds of the surface of the solid crust of the globe. And in tracing the variations of temperature and its distribution at various depths over the whole oceanic sea-bed, we were in reality studying one of the most important of the physical conditions which affect the distribution of marine animal life and the direction and force of ocean currents.

We have yet the pleasure of anticipation in regard to the third Lecture, by Mr. Wallace, on "The Comparative Antiquity of Continents, as indicated by the Distribution of Living and Extinct Animals," which I hope we shall hear at the Ordinary Meeting of the 25th of June.

In a similar spirit of improvement and progress, the Council have at this moment under consideration the re-organisation of their Map Department, for which the resignation of their Curator, Capt. C. George, after a faithful service of twenty years, affords a favourable opportunity. They have in view to make it not only more complete and readily accessible, but to increase its utility by giving facilities for the use of their Diagrams, when required to illustrate

Lectures in the provinces, at a small fixed charge. It may involve some increased establishment and corresponding expense; but the Society is rich enough not to hesitate, if they can see their way to the useful application of their funds. Lending Diagrams, no doubt, exposes them to damage, and the Society to the cost of their renewal; but a comparatively trifling charge would probably cover this expense, while the service it will render to those who may not have occasion for the same Diagrams more than once or twice, would be great.

Turning from this aspect to our own progress, the Report of the Council affords sufficient proof of the increasing prosperity, and, I trust, of the usefulness of the Society. Our Members and income alike increase year by year; and so largely as regards the first, that it has become a subject of embarrassment on those rare occasions of extraordinary interest—such as the return of Cameron and the Arctic Expedition—when the great body of Fellows desire to attend the Meetings. Some not unnatural dissatisfaction was felt at the impossibility of many, on both these occasions, obtaining seats; and a Special Meeting was called to consider and report upon some Resolutions brought forward by Sir Mordaunt Wells, with a view to remove in the future the causes of complaint. Although some appearance of discord in our midst ushered in the discussion, the result was the appointment, with the full concurrence of the Council, of a Joint Committee of Inquiry; and its sittings, I am glad to say, were marked by the most perfect good feeling, and great unanimity as to the objects of the inquiry. The new Regulations, submitted for your approval at this Meeting, were carefully considered with the single object of providing for the convenience of the Fellows on all occasions—ordinary and extraordinary—and remedying as far as possible the evils hitherto complained of. Whether they will, in practice, effect this end, or be more successful than various others that have been already tried with a similar object, is a question on which the Council scarcely feel justified in pronouncing any very decided opinion; but they saw no objection to their adoption as a tentative course proposed by the Joint Committee appointed for that purpose at the Special General Meeting of March 5th. Some of the difficulties are, I fear, insuperable, and no rules that can be devised will wholly prevent inconvenience and disappointment, when the numbers to be accommodated are so large. One trifling change in the standing rule determining the day for the Anniversary Meeting has been pro-

posed by the Council, merely to guard against being compelled to hold it on a day inconvenient to every one, such as Whit Monday or any other public holiday. Had any discretionary power been allowed, I should have deferred the Meeting on this occasion for another week, as the Whitsun holidays are still unexhausted.

Before terminating these preliminary remarks, I must express on your behalf, as well as on that of the Council and myself, our cordial thanks to the Senate of the University of London for the continuance of the privilege they so liberally accord us of holding our Meetings in this commodious Hall.

I will now proceed to the matters of more permanent interest, which form the proper subject of this Report. And my first duty, in accordance with past traditions and the usual order of proceeding, is to bring before you a record of the losses sustained since the last Anniversary by the death of many distinguished Geographers, and fellow-labourers in this field.

### OBITUARY.

ADMIRAL SIR EDWARD BELCHER, K.C.B.—By the death of Sir Edward Belcher, on the 18th of March, in his 78th year, the Society has lost one of its oldest and most distinguished Fellows. He was one of the original members, of whom scarcely twenty now remain, who joined it on its formation in 1830.

Sir Edward Belcher was both a scientific and a practical cultivator of Geography, as well as an accomplished master in the kindred science of Hydrography. He was essentially a worker. A student of science from his boyhood, he has left his mark on many branches of it, and his works will long survive him. Many who have preceded him, and some who still remain, have owed, in great measure, to his example and instruction much of the eminence to which they may have attained in public life. It is, however, to his services as a geographer and explorer that we confine ourselves in this brief record.

He first brought himself into public notice when he sailed with Beechey as a Lieutenant and Surveyor on board the *Blossom*, in her voyage to the Pacific and Behring Straits. In this voyage, which extended over nearly four years, Lieutenant Belcher took a most active and important part.

In the comparatively imperfectly known condition of the Pacific at this period, the duties of a surveying ship were chiefly confined

to fixing accurately the astronomical positions of the various groups of islands which were fallen in with, making such cursory examinations and surveys as time would admit of, and expunging from the charts many supposed dangers which the uncertainties of longitude had repeated in several positions, and which proved a source of anxiety and perplexity to the ordinary navigator.

In this way the *Blossom*, leaving the coast of America, visited the Easter, Ducie, and Pitcairn Islands, the latter celebrated in connection with the mutiny of the *Bounty*; she thence proceeded to the Gambier Group, which were surveyed in considerable detail; subsequently, to many of the low coral isles of Polynesia, when several new ones were discovered, and the positions of others correctly determined, and in March 1826, she reached Tahiti, the principal of the Society Group. After remaining a few weeks here, she sailed for Behring Straits, by the Sandwich Isles and Kamtchatka, a portion of her captain's instructions being that she should pass the summers of 1826–27 in this region in order to co-operate with Parry and Franklin, then exploring the Arctic Seas, in case either of them should succeed in accomplishing the North-West Passage. In July 1826, the ship reached Kotzebue Sound, when, with the assistance of her decked boat, a survey of the coast to the North was commenced, the ship herself reaching a point which was named Cape Franklin in  $71^{\circ} 7'$  N. latitude, and her barge a position considerably further advanced. Foiled in their expectation of meeting Franklin's land party, although the boat had reached within 120 miles of his farthest western position, the *Blossom* quitted Behring Straits in the middle of October, and returned to resume her surveying duties in the Pacific, until the time should again have come round for a second attempt. During this second stage of the voyage, San Francisco, then under the Mexican flag, was visited and surveyed. From thence the ship proceeded again to the Sandwich Isles, searching unsuccessfully for various reported islands on the route, and arrived at Honolulu in January 1827. Early in March she bore away across the Pacific for China, rectifying the positions of such islands as lay near her course. Macao was reached in April. The Loo Choo Isles were subsequently visited, and some weeks were passed in making such observations and examinations as were possible in this little-known locality. Passing thence northward to Kamtchatka, Kotzebue Sound was again reached on the 5th of August, 1827. Here the decked boat was prepared for a second voyage of exploration to the North, and under Lieutenant Belcher's command



examined the coast from Chamisso Island to a position beyond Icy Cape, a distance of between 300 and 400 miles. On his return to Kotzebue Sound, after experiencing many risks, his little vessel was driven on shore in a gale of wind, and totally wrecked on Chamisso Island, three of her crew being drowned. The *Blossom* now finally quitted Behring Straits, all hope of attaining the principal object of her mission, viz. the meeting with Franklin, being at an end. After revisiting California and other ports on the American coast, she rounded Cape Horn, and returned to England in October 1828.

Lieutenant Belcher having been promoted to the rank of Commander in 1829, was in 1830 appointed to the command of the *Ætna*, employed in surveying the West Coast of Africa and parts of the Mediterranean. One of the principal features of his African work was the close examination of the dangerous shoals which extend some 70 miles off the coast in the neighbourhood of Rio Grande, south of the Gambia. This he effected by carrying off a floating triangulation by means of his ship, the *Raven* tender, two decked barges, and large beacon buoys, all of which were moored in position, and thus formed fixed objects from which to correctly determine the position of the shoals, and to carry out the necessary soundings. The violent surf on this part of the African coast, together with the hostility of the native tribes, rendered surveying not a little harassing as well as hazardous. It was in this neighbourhood that Captain Skyring subsequently fell a victim to the treachery of the natives.

The *Ætna* was ordered to pass the winter of 1832 within the bar of the Douro River, for the protection of British interests during the struggles between the parties of Doms Pedro and Miguel. Here Captain Belcher lost no opportunity of distinguishing himself; on one occasion he opened a communication with the Miguelites, by which the merchants inside and the squadron outside were enabled to obtain fresh supplies. The *Ætna's* crew, moreover, habitually manned the Bar boat which kept up communication with the squadron, and while exposed to the danger of the surf in crossing the Bar in rough weather, not unfrequently became a target for both the contending parties. Being on the spot myself as one of the besieged, I can bear personal testimony to the excellent service rendered by Captain Belcher and his crew during this trying period.

On the raising of the siege of Oporto, the *Ætna* went up the Medite:ranean, and among other services there thoroughly examined

the Skerki Rocks, settling the question that there was one, and not two, as had been reported.

On the paying-off of the *Ætna* in 1833, Captain Belcher was employed for some time on the survey of the coasts of the United Kingdom, principally in the Irish Channel.

We next find him in command of a Surveying Expedition, composed of the *Sulphur* and *Starling*, in the Pacific. In this voyage, like that of the *Blossom*, it was not contemplated that any very extensive surveying operations of a consecutive character could be carried out; neither the coasts nor isles of the Pacific were yet ripe for such operations; the great land-marks of the picture, so to speak, had to be firmly established before the details could be filled in, and so the voyage in question was principally occupied in carrying chronometrical distances between distant points, and making such accurate surveys as time would permit over a more or less limited area in the neighbourhood of these principal stations. Thus at Panama, where Captain Belcher assumed the command of the Expedition in January 1837, a survey was made of its bay and neighbourhood, when the two vessels immediately proceeded to San Blas in Mexico, nearly 2000 miles distant, examining *en route* the ports of Realejo and Libertad; they then stretched across the Pacific to the Sandwich Isles, a further distance of nearly 3000 miles. In this run Clarion Island was visited, and a cluster of islands which had been reported between the meridians of 130° and 135° w. proved not to exist, the same which had been unsuccessfully searched for by the *Blossom*.

On the 23rd of July the ships sailed from the Sandwich Isles for the North, and reached Port Etches, in King William Sound, lat. 60° 30' N., towards the end of August. The principal object of this cruise was to settle the discrepancies between the longitudes of Cook and Vancouver, and to determine the position and height of that great feature in the coast-range of North-West America, Mount St. Elias. The necessary surveys having been completed for the accomplishment of these objects, the Russian Settlement of Sitka was next visited; and, after calling at Nootka Sound, in Vancouver Island, to determine the longitude, the ships proceeded to San Francisco in California, which they reached on the 19th of October. During their stay there of about a month, the River Sacramento was surveyed for a distance of 150 miles from the ships' anchorage. Leaving San Francisco the end of November, and examining several portions of the coast and islands adjacent, San

Blas was again reached on the 20th of December, 1837. The next important stage on the voyage was Callao, where the *Sulphur* arrived in June 1838, having in the mean time visited and surveyed Acapulco, the Gulf of Papagayo, Port Culebra, and Cocos Island.

After a refit at Callao, the Coast of Peru was surveyed for about 60 miles to the south, when the ships again proceeded north, and, after securing observations at Payta, and making some examinations in the Gulf of Guayaquil, they arrived at Panama in October, where the first stage of the voyage may be said to have ended.

By the end of March 1839, surveys were completed of the extensive Gulfs of Fonseca and Nicoya in Central America, as well as of Pueblo Nuevo and Baia Honda, after which the Sandwich Isles were again visited, and then the ships moved northerly, repeating, to a great extent, the cruise of 1837, verifying observations then obtained, and adding to the work by new surveys. By September, the Bar and entrance of the Columbia River had been surveyed, and a reconnoissance of the river made as high as Port Victoria, the chief trading port of the Hudson's Bay Company. After leaving the Columbia, the ships proceeded to San Francisco, and from thence examined the Coast of California, and surveyed its several ports as far south as Cape St. Lucas, the entrance of the great gulf. At San Blas, which was reached in December 1839, orders were received to return to England by the western route, thus completing the voyage by a circumnavigation of the globe.

Accordingly, on the 1st of January, 1840, the two vessels set sail once more across the Pacific. The islands of Socorro and Clarion were visited, and their positions determined. The Marquesas Islands were reached the same month, and then they passed on to Bow Island, a coral formation in the lagoon, where six weeks were spent in the operation of boring for the volcanic formation on which these islands were suspected to rest. Subsequently Tahiti, and other of the Society Islands, were visited, and in succession the Friendly Group, the Fijis, New Hebrides, New Ireland, and New Guinea; at all of which observations were made, and such surveys as time would admit of.

The ships then passed through Dampier Strait, called at Gilolo, Amboyna, Macassar, and reached Singapore in October of the same year. Here Captain Belcher found orders to proceed immediately to China, and for more than a year the *Sulphur* and *Starling* took an active part in the hostilities with that country, making

such surveys as were essential to enable the fleets and the land forces to act with the best effect, and which tended materially to the capitulation of Canton, and the successful issue of the campaign.

The *Sulphur* finally arrived in England in July 1842, after a voyage extending over little short of seven years. For these services Commander Belcher received his post-rank, was nominated a Companion of the Bath, and shortly afterwards received the honour of Knighthood.

On the conclusion of peace with China, which followed shortly after the *Sulphur's* return, it was decided to commence a regular survey of the coasts, ports, and rivers, north of Canton; and the *Samarang*, a 26-gun frigate, was prepared for this service, Sir Edward Belcher being appointed to the command of her in November 1842. Political considerations, however, led to the *Samarang's* sphere of action being shifted to Borneo and the neighbouring islands of the Eastern Archipelago north to Japan—a sufficiently wide limit, embracing as it did some 40 degrees of latitude.

The vessel reached her station in the middle of 1843, and immediately commenced her work at the Sarawak on the west side of Borneo. Here she had the misfortune to ground on a reef, fall over, and sink in the river; but by the skill and energy of her captain was raised again, and, with the loss of less than a month's time, proceeded on her mission, viz. the examination of the Bashee Islands, the Majico Sima group east of Formosa, Luzon, Mindoro, and Mindanao of the Philippines; the Sulu Isles, Celebes, and Ternate.

At the conclusion of this stage of the voyage, Sir Edward Belcher having been severely wounded in a boat-encounter with the piratical prahus of Gilolo, the ship returned to Singapore, and after a short rest there resumed her employment, revisiting some of her former stations, examining portions of Loochoo, the island of Quelpart, the Korean Archipelago, and Japan; she returned thence to the Mindoro and Sulu Seas, and concluded her labours by surveying the north-west coast of Borneo, from the island of Balam-banjan, in the Strait of Balabac, to Labuan, then just become a British possession. The *Samarang* was now ordered home, and reached England on the last day of 1847.

Sir Edward Belcher's next employment afloat was in command of an expedition to the Arctic Seas in search of the missing ships under Sir John Franklin. This expedition, consisting of five vessels, left England in April 1852, and on arrival at Beechey Island, in Barrow

Strait, was separated into two divisions, the one proceeding westward to Melville Island, while Sir Edward himself, with two ships, ascended the Wellington Channel, and wintered at its head in an inlet which he named Northumberland Sound, in lat.  $76^{\circ} 52' N.$  In the spring of 1853 he personally explored by sledges to the north, discovered and partially surveyed North Cornwall in  $77^{\circ} 30' N.$ , and the strait which bears his name leading eastward into Jones Sound; while other parties from his ships discovered and explored the north shores of Bathurst Island and Melville Island; and, crossing the latter, communicated with the division of the squadron under his second, Captain Kellett. A second winter was passed in Wellington Channel, and in the autumn of 1854, there seeming no probability of extricating the ships, four of them were abandoned, the crews returning over the ice to Beechey Island, whence they proceeded to England. With this voyage closed Sir Edward Belcher's active professional career; but he has continued to be a valued working member of this and other kindred Societies, and his active and gifted mind was devoted to the pursuit and cultivation of science and knowledge up to the latest days of his life.

Lord MILTON.—Amongst the Fellows of more than ordinary distinction, removed by death during the past year, I regret to have to include the name of Viscount Milton, who died in January last, at the early age of thirty-eight. Lord Milton had been a traveller from his youth up, and, in spite of a delicate frame and frequent illness, he succeeded in accomplishing substantial geographical work of considerable importance. His uncertain health compelled him to seek fresh life and vigour from time to time in some more bracing climate; and after several journeys to the Continent, and one to Iceland in 1861, he crossed the Atlantic to North America, and visited the regions to the west of the Red River Settlement in the Hudson Bay Territories. The favourable effect upon his health produced by the invigorating climate of the Great Plains, and the charm of the wild life there, induced Lord Milton to return there the following year, in company with Dr. Cheadle, with the view of making a more extensive exploration of the North-West Territory. At that time the gold mines of Cariboo, in British Columbia, were attracting much attention, and the only practicable route to them was the extremely circuitous one by Panama, or the little less indirect and more toilsome journey through United States territory by

way of California. Although the rich mining districts of British Columbia lie almost in the direct line across the Continent through British territory, the way was barred by the great chain of the Rocky Mountains; and on each side of the main range lay a wide extent of rugged country, covered with dense forest, and in great part unexplored. Lord Milton and Dr. Cheadle determined to make the attempt to discover a way through this difficult and trackless region which separated the plains of the Saskatchewan from the mining districts of British Columbia, and they set out on this expedition in the spring of 1863. The story of this adventurous and toilsome journey, graphically related by Lord Milton and his companion in "The North-West Passage by Land," is probably familiar to most of us. Provided with very inadequate resources for such an arduous undertaking, the party endured great hardships and privations before they succeeded in forcing their way by the Yellow Head or Leather Pass, and through the dense forest of the North Thompson River, to the plains of Kamloops. Had Lord Milton enjoyed the full vigour of health, his enterprising spirit would have led him to further geographical research. But the renewed strength, which, in spite of its hardships, he eventually obtained from this journey, did not endure. After the lapse of a few years, he was compelled by increasing illness to resign the seat in Parliament to which he had been elected after his return, and he once more crossed the Atlantic to North America. The last few years of his life he spent chiefly in the highlands of Virginia; returning to England, however, shortly before his death at the commencement of the present year.

The practical value of Lord Milton's work has been well shown by subsequent events. His Expedition served, perhaps more than anything else, to direct public attention to the immense value of the southern portion of the Hudson Bay Territories, and to the great importance of establishing a way of communication between the eastern and western portions of British North America. This has been followed by the acquisition, by the Dominion of Canada, of the Hudson Bay Territories; and since that was effected, complete surveys have been carried out for a road and railway across the Rocky Mountains into British Columbia. These works have, indeed, been actually commenced; and the line chosen is identical with that followed by Lord Milton's Expedition. The route traversed by his party, with so much toil and difficulty, will before long complete the link of communication between the Provinces of

the Canadian Confederation, and eventually become the great highway to the Pacific through British North America.

LOUIS ARTHUR LUCAS was the only surviving son of the late Mr. Philip Lucas, of Manchester, a gentleman well known for his liberal charities and philanthropy. Our deceased Associate was born on the 22nd of September, 1851, and at the time of his death was only twenty-five years of age. He was educated at University College School, in Gower Street, from which he passed to University College, where he showed a marked taste for scientific subjects. He studied Chemistry under Dr. Williamson, and was an apt and skilful experimentalist. At a very early age he expressed a desire for a life of adventure; but his parents having destined him for commercial pursuits, he was urged to fit himself for a business life at Manchester. His thirst for travel and scientific enterprise, however, prevailed; and was increased, rather than slaked, by a trip to Switzerland in 1870, during which he made an unusually rapid ascent of Mont Blanc. Before settling down to business, he visited the United States in 1872; and, after making the ordinary tour through Canada and part of the Eastern States, extended his tour to the "Far West," for the purpose of seeing the Indians and shooting buffaloes. By good fortune he met General McClellan on the Pacific Railway, who most kindly gave him letters of introduction to the Commandants of the Forts in the West, and these officers afforded him the opportunities he required. He shot buffalo and deer in Nebraska, puzzled the Indian Chiefs by his tricks of legerdemain, in which he was a most skilful amateur, and returned home at the end of 1872, after a most adventurous trip of four months' duration.

At the commencement of the following year he had the misfortune to lose his surviving parent (his mother), and soon after fell into a delicate state of health, for which change of air and scene were ordered. He selected Egypt as his health resort, and started at the end of 1873, with a doctor as his companion. He did not on this occasion show any marked spirit of enterprise; his state of health, and the domestic affliction from which he had suffered severely, precluded the desire for much adventure. However, he thoroughly enjoyed the Nile; and Eastern life, as so often is the case, cast its *glamour* over him, and on leaving Egypt he determined, whenever the opportunity offered, to return and see more of the country and of the people. His return to England was delayed by an attack of

typhoid fever, supposed to have been caught at Naples, the subsequent effects of which lasted for many months, during which time he devoted himself to the study of science. He studied Botany with ardour, and made considerable progress in that subject. He also studied Comparative Anatomy, Zoology, and Geology, and during the whole winter and following spring led the life of an industrious student. Feeling now qualified for the great task he had set himself, in the month of July 1875, he announced to his family his intention to devote himself to African exploration, and that he had determined to seek out the source and the course of the River Congo. His family received this intimation with dismay, feeling assured he was unfitted by his youth and constitution for such an undertaking. They addressed themselves without delay to Sir Henry Rawlinson, our late President, begging him to use his influence to deter him from so hazardous an expedition; but Sir Henry's endeavours and the efforts of other influential friends were alike unavailing. Mr. Lucas was resolved to go, and organised his Expedition independently of our Society. Having become acquainted at the Geographical Congress of Paris in July 1875, with Dr. Nachtigal and Dr. Schweinfurth, he obtained valuable advice regarding his equipment and route from those travellers. He left London on the 2nd of September 1875, and made his way to Cairo, where he remained several weeks learning Arabic, engaging servants, and making preparations for his Expedition. He obtained a firman from the Khedive, after a personal interview, at which he was most graciously received, authorising him to enlist and train soldiers for escort; and from all quarters he received assistance for the great objects he had in view. He travelled by way of Suez, Suakim, and Berber to Khartum, where he arrived at the end of January 1876. He remained for nearly three months in Khartum, organising his Expedition, and making preparations for the absence of several years beyond the limits of civilisation. Delays also occurred in communicating with Colonel Gordon, with whose consent only could a traveller ascend the Nile into the Central Provinces. All difficulties having been overcome, in April Mr. Lucas left Khartum, and, with the assistance of the steam-vessel lent by Colonel Gordon, ascended the White River as far as Lardo, where he met Colonel Gordon. It very soon became apparent that Mr. Lucas's Expedition could not succeed. Colonel Gordon showed him that his escort was too weak and too untrustworthy for him to venture to the southward, either through Albert Nyanza or through



Rumanyika's country, between the Lakes Victoria and Albert to Nyangwé, which place he wanted to make the true starting-point for his discoveries. Colonel Gordon pointed out to him that if he persevered in his Expedition, with such an insufficient escort, he would be either massacred by hostile natives, or deserted or shot by his own men; and that he (Colonel Gordon) would not permit him to go on to certain destruction. Mr. Lucas most reluctantly yielded to these arguments, and later submitted himself unreservedly to Colonel Gordon's advice. Colonel Gordon's advice was, if still bent on African exploration (against which he strongly dissuaded him as being unfitted by health and constitution), to return to Khartum; and thence go by way of Suez to Zanzibar, there to organise his Expedition, and make a fresh start under better auspices, and in a less deadly climate, to those sources where he hoped to gather fame and honour. Mr. Lucas nevertheless accompanied Colonel Gordon to the Albert Nyanza, and navigated the northern portion of the Lake in the first steamboat ever launched on its waters. In August 1876, Mr. Lucas turned his steps northwards, intending to carry out his original scheme of the exploration of the Congo in the manner suggested by Colonel Gordon. His health had already suffered considerably from fever, and when he reached Khartum, on the 4th of September, he was unable to walk. Indeed, for several weeks previously he had been carried on an angareb by his porters. During the months of September and October, attack followed attack of fever and dysentery, and, utterly prostrated by these illnesses, he at last was compelled to give up his cherished scheme of African exploration, and determined to return to England. This resolution came too late. On the 26th of October, though dreadfully weak, he was sufficiently improved in strength to be moved from Khartum. He left in a dahabiah especially provided by the kindness of the Khedive, and reached Berber on the 2nd of November. He then, eager to reach home, began the desert journey to Suakim, without waiting to recruit his strength; he crossed the desert in six days, and on the 18th of November he arrived at Suakim. Whether exhausted by the fatigue of the journey, or as a result of the disease, at Suakim he had an accession of illness. He was in an exhausted condition put on board the S.S. *Massowah*, bound *viâ* Jeddah for Suez, and within twelve hours, viz. on the 20th of November, he died suddenly, at the early age of twenty-five. His remains were landed at Jeddah, and interred in the cemetery there with much honour and respect. His aims were noble, his character

inflexible and most persevering; his scientific qualifications were considerable; he possessed great warmth of heart and most genial manners, which endeared him to all who knew him, but he lacked the physical qualities necessary to constitute an African explorer.

Captain JOHN EDWARD DAVIS, R.N.—The sudden death of this active and zealous officer has caused the greatest grief amongst his connections and friends, many of whom, like himself, were well known in geographical circles.

He entered the service in 1828 or 29, and served in various ships on the Pacific and West India Stations. In 1835 he joined H.M.S. *Beagle*, under the late Admiral Fitzroy, which may be said to be the commencement of his thirty-six years' service in the scientific branch of the Royal Navy. Whilst in that ship he assisted in the survey of the coasts of Chili and Peru.

In 1839 he was appointed second master of H.M.S. *Terror*, on the Southern Expedition commanded by the late Sir James C. Ross, and made three voyages to the Antarctic regions, fulfilling the duties of surveyor and draughtsman to the Expedition. On his return in 1844 he was promoted, and appointed to the survey of the West Coast of Ireland, under Captain G. A. Bedford (now Vice-Admiral) where he served with great credit for nearly ten years, joined afterwards the survey of the South Coast of England and that of the Orkneys.

In the spring of 1860 he was detached from home service to accompany the *Fox* in her Expedition to discover tidings of Sir John Franklin's ships, returning to Portland Roads in November of the same year. Since that date he had been employed as Naval Assistant in the Hydrographic Office of the Admiralty. During his service there he conducted a series of experiments on thermometers for deep-sea purposes, which led to those used so successfully in H.M.S. *Challenger* in her recent voyage of discovery, and he devised also improvements for sounding in great depths.

He was the inventor of an improved astronomical sextant, by which, through the adaptation of a micrometer movement, a series of observations can be made without the necessity of reading-off at the time of observing, and other advantages, which met with the approval of the Astronomer Royal. He also completed and published Azimuth Tables that had been commenced by the late Staff-Commander Burdwood.

Captain Davis had only retired from active service about two

months, having served in the Navy for nearly half a century. Latterly he had been giving lectures in various parts of England on Arctic Explorations, and at the time of his sudden death was engaged to deliver one at Bristol, for which he had just completed drawings and diagrams.

WILLIAM BOLLAERT, our late genial Associate, was born in 1807, and at an early age entered into scientific pursuits. He was for some time Chemical Assistant to Sir Humphry Davy, Mr. Brande and Mr. Faraday, at the Royal Institution, and made some original discoveries in benzoic acid. But, owing to his father's affliction of blindness, and consequent inability to attend to his profession of medicine, Mr. Bollaert was unable to continue his connection with the Laboratory of the Royal Institution, and accepted an offer to go to Peru as assayer and chemist in the survey of silver mines. His subsequent accounts of the silver mines of Guantajaya and other famous mines of the Province of Tarapaca, which have been published, contain much useful information.

Whilst in Peru, Mr. Bollaert devoted a great deal of his attention to the geography, geology and natural history of the country, and wrote many interesting papers on these subjects, which have been read and published by various Societies. In 1827 he made, at the request of the Intendente Castilla (afterwards President of Peru), a survey of the Province of Tarapaca, and his "Observations on the Geography of Southern Peru, including Survey of the Province of Tarapaca and route to Chile by the coast of the Desert of Atacama" were read before our Society in 1851. He also published much useful information regarding the nitrate of soda, and the formation of the new boracic acid mineral, in Peru. Mr. Bollaert was one of the first "white" men who crossed the Desert of Atacama, exploring the country, and searching for the meteoric iron of Atacama.

Returning to England, Mr. Bollaert endeavoured to make arrangements, under the patronage of our Society and of the Government, to explore the East Coast of Africa from Zanzibar, to visit Lake Nyassa, and to ascertain the probabilities of an Expedition crossing the African Continent. He was, however, unable to get his proposals carried out.

In 1832-33 he accompanied the late Sir John Milley Doyle to Portugal, and served as a volunteer. During this time he gathered the materials for his publication on the 'Wars of Succession of Portugal and Spain from 1826-1840, containing an account of the

Siege of Oporto in 1832, and Political and Military Reminiscences.' For his services he received the War Medal, and was created a Knight of the Order of the Tower and Sword of Portugal. He was subsequently engaged in assisting the late Baron de Haber in financial matters relating to Dom Carlos and Dom Miguel, and received from the hand of Dom Miguel the decoration of the Order of Fidelity.

On the abdication of Dom Miguel and Dom Carlos, Mr. Bollaert went to Texas to explore the country as to its fitness for European emigration, and at the request of H.B.M. Consul at Galveston, he examined the interior and coasts, and made Reports thereon, which were sent to the Admiralty. He supplied some interesting papers on the Indian tribes of Texas, and on the botany and natural history of the country, for various Societies and publications. But owing to his health being impaired by yellow and intermittent fevers, he returned to England.

In 1853 Mr. Bollaert received the Bronze Medal of the Society of Arts from the hands of the President, the late Prince Albert, for his "Essay on Salt, with Observations on the Origin of Salt and Saline Bodies," and giving further details of the inexhaustible quantities of nitrate of soda existing in Peru, and information concerning a new boracic acid mineral. He afterwards returned to Peru, and made some valuable antiquarian and ethnological researches in New Granada, Ecuador, Peru, and Chile, accounts of which, with his 'Observations on the Pre-Incarial, Incarial and other Monuments of Peruvian nations,' were published by Messrs. Trübner & Co. Several interesting papers on the gold ornaments, pottery, &c., discovered by him in the ancient tombs of Peru, were published by the Society of Antiquaries in London, and he presented to the British Museum several specimens, amongst others a unique vase representing the head of a Chinese Ruler.

Mr. Bollaert was requested to examine the coal mines of Chile, and his Reports on the same were read in the University of Santiago in Chile, and before the Royal Geographical Society in London. For this, and for his researches in Peru, the University of Santiago elected him a corresponding Member. After remaining for some time in South America, visiting the whole of the West Coast, crossing the Andes and visiting the Argentine Republic, Paraguay, and the Brazils, he returned to England.

A severe illness and rupture of the lungs quite incapacitated him for any further active life; but up to the close of his career he took

the greatest interest in the Societies of which he was a Member, and from time to time published accounts of his researches for the Royal Geographical Society, the Ethnological Society, the Society of Antiquaries, the Medico-Botanical Society, the Anthropological Society, the Society of Literature, and for various publications.

He died on the 15th of November last, in his sixty-ninth year.

Professor K. E. VON BAER.—This eminent savant, equally celebrated as a Naturalist and Geographer, died on the 28th of November last, at Dorpat. He was elected Corresponding Member of our Society as far back as 1843, about which time he acquired a high reputation as a scientific traveller, by his journey to Lapland and Nova Zembla, which he undertook under the auspices of the Imperial Academy of Sciences of St. Petersburg. His family came originally from Hanover; but at the time of his birth, in 1792, were settled in Esthonia, and it was not until 1834 that Von Baer took up his permanent residence in St. Petersburg. He had received a medical education, first at Dorpat, and afterwards at Vienna and Würzburg; but his tastes inclined him, as he grew to manhood, to the study of Zoology, and in 1822 he was appointed Professor of that science at Königsberg, where he founded the now existing Zoological Museum. His eminently active mind preserved him from a life of contracted studies in a special branch of science, and he was always to the fore as an organiser or administrator in all that concerned the subjects which he had studied. In the Imperial Academy of St. Petersburg, he first served as Councillor and Librarian; but his activity was afterwards displayed in a variety of public ways,—in Educational questions, University organisation, sanitary matters, and so forth. His Expedition to Lapland and Nova Zembla took place in 1837, and he was the first to make and bring home a collection of plants from the latter region, where he spent six weeks in assiduous research. In the years 1851 to 1856 he was employed by the Government in investigating the fisheries in the Volga and Caspian, the result of which mission was the important geographical work in four volumes, with Atlas, published by him at St. Petersburg in 1857-9. On his retirement from the Academy in 1861, he was elected an Honorary Member. Although this is not the place to enter into details regarding his work as a Biologist, his great and special services to science as a philosophical thinker and worker in the great subject of evolution, must be mentioned. In connection with this may be cited his im-

portant work, 'Ueber Entwicklungsgeschichte der Thiere.' Among his geographical works may be enumerated his Paper on the effect of the earth's rotation on the erosion of river-banks—an ingenious treatise, in which the tendency of rivers gradually to swerve from a direct course, since known as "Baer's Law," was attempted to be proved and explained—and his well-known 'Kaspische Studien.' Conjointly with Count von Helmersen, he also edited the long series of volumes of original Papers on Russian Geography, entitled 'Beiträge zur Kenntniss des Russischen Reiches und der angränzenden Länder Asiens,' a serial publication of great value to geographical students, which extended over the years from 1829 to 1873.

The MARQUIS DE COMPIÈGNE.—This enterprising traveller, whose premature death at Cairo on the 28th of February last, at the age of thirty years, excited much public attention at the time, was a Fellow of our Society, having been elected in 1873. He commenced his career as a traveller by a tour, chiefly inspired by the love of adventure and the chase, in the Southern States of America, particularly in Florida, of which he published an amusing account in the 'Tour du Monde.' In 1873, actuated by the desire of Geographical discovery, he undertook, with his colleague, M. Marche, a more serious journey to the Gaboon, and organised there an Expedition up the river Ogowé, which, according to the report of traders and natives, had its origin in a lake in the far interior of Equatorial Africa. The means for this important journey were obtained, M. de Compiègne subsequently stated, by the sale of objects of Natural History obtained by himself and his companion. Arrived at the Gaboon, they commenced their boat-journey up the Ogowé on the 9th of January 1874, and by the end of March of the same year had reached the country of the cannibal Osyeba, a tribe which had not previously been visited by Europeans. Here at the confluence of the Ivindo their party was attacked by this hostile and implacable tribe, and after the loss of many men in the struggle which ensued, they were forced to retreat. The observations made during this adventurous voyage were published by M. de Compiègne on his return to Paris, under the title of 'L'Afrique équatoriale:—Gabonais, Pahouins, Gallois; and Okanda, Bangouens, Osyeba," 1875. About the same time, an Expedition on a larger scale, under the leadership of M. de Brazza, was organised in Paris, for the continuation of the line of discovery opened up by

this enthusiastic young traveller; but the much impaired state of his health did not permit him to take part in it, and he accepted the offer made to him by Dr. Schweinfurth of the post of Secretary to the Société Khediviale de Géographie, recently established in Cairo, of which Dr. Schweinfurth was then President. The duties of this position he had filled for about a year, when he died, in consequence of a wound received in a duel, on the 28th of February last.

MONSIGNOR FRANCESCO NARDI.—In the month of March last died at Rome one of our Honorary Corresponding Members, Monsignor Francesco Nardi, for some particulars of whose biography I am indebted to his old and intimate friend, His Excellency the Commendatore Cristoforo Negri, also one of our Honorary Corresponding Members, and the distinguished Founder of the Geographical Society of Italy. Francesco Nardi was born of a noble family at Vazzola, near Conegliano, in the province of Treviso, in 1808. He entered the ecclesiastical profession, and soon distinguished himself in his studies by versatility of genius and a most retentive memory. During the Austrian dominion in Venetia and Lombardy, many Italian youths went to study at Vienna, Monsignor Nardi among them, and he was in the superior Institute of Theology, founded by Joseph II., for the teaching of principles alike uniform and noble in the education of the clergy. Cristoforo Negri was at the same time studying law in the same University. A few years afterwards both were nominated to Professorships in the University of Padua,—Nardi of Common Law, and Negri of Political Science. They had already both of them studied Geography at Vienna, and continued their studies at Padua, and both in turn lectured there on Statistics. The Revolution of 1848 separated them. Negri emigrated to Turin, Nardi remained at Padua, whence he removed to Rome as Auditor of the Rota Romana for Austria. There Monsignor Nardi read to the Accademia Pontificia de' nuovi Lincei several geographical papers on the African and Polar Expeditions, and on the Cruise of the *Challenger*. Politics, however, had already diverted him from peaceful and quiet studies. He was one of the most indefatigable, earnest, and even violent defenders of the cause of the Pope; Director of the 'Voce della Verità' newspaper, and a frequent traveller to every part of Europe on missions imposed upon him or undertaken voluntarily. This precluded him from that eminence in geographical

studies to which he might have aspired from his genius, his culture, his linguistic attainments, and his widespread relations with men of learning in every part of Europe and elsewhere. For many years Nardi had been a member of numerous scientific bodies, and seemed likely soon to attain the Cardinalate, a position he much coveted, having been nominated "Secretary of the Congregazione dei Vescovi," an office which usually opens the road to that dignity.

It may be said of Nardi that no difference in political opinions, even the most diametrically opposite, ever interfered with his affection and esteem for those whom he had once reckoned among his old friends.

CHARLES ENDERBY, F.R.S.—The late Mr. Charles Enderby was the son of Mr. Samuel Enderby, whose name was familiar to all geographers some thirty years ago as the enterprising merchant whose vessels, engaged in the whale fishery of the Southern Seas, made so many important discoveries in the Antarctic Ocean. Among these discoveries was that of the Auckland Islands, south of New Zealand, made by Captain Abram Bristow in 1806, whilst in command of one of the vessels belonging to the Messrs. Enderby; and some years after, Enderby Land, further to the east. Our late Associate, on succeeding to the business with his brothers, maintained the reputation of his house for its enlightened care of scientific interests; and it was under his direction that Captain Biscoe discovered Graham Land, and other portions of the Antarctic continent, previous to the voyage of Sir James Ross. The Auckland Islands were ceded to Messrs. Enderby by Her Majesty's Government as a whaling station, and in 1849 a whaling establishment was formed there under their auspices. Previous to this, Mr. Charles Enderby published a pamphlet on the group, under the title of 'The Auckland Islands, their Climate, Soil, and Productions,' a work which comprises nearly all that was known at the time regarding this region. Mr. Enderby served on our Council in the years 1842-4, and again in 1845 and 1847. He died on the 31st of August last. He was one of the original Members of the Society, having entered in the year 1830.

The Right Hon. Sir DAVID DUNDAS.—This distinguished lawyer, who died on the 31st of March last, at his residence in the Temple, always took a deep interest in geographical studies. He was for



many years a Member of the Council of the Hakluyt Society, and was latterly its President. The eldest surviving son of the late Mr. James Dundas, of Ochtertyre, in Perthshire, he was born in 1799, and educated at Westminster School and Christ Church, Oxford, where he took his degree at the age of twenty-one. He was called to the Bar in 1823, and made Queen's Counsel in 1840. In the latter year he was elected Member of Parliament for Sutherlandshire, and represented that county continuously for twelve years, until 1852; in 1861 being again re-elected until 1876. He was Solicitor-General from 1846 to 1848, and Judge-Advocate-General from 1849 to 1852. He was elected a Fellow of our Society in 1841, and served on the Council in the years 1853 and 1854.

Captain CHARLES STUART FORBES, R.N.—The death of this adventurous officer and genial companion, at the comparatively early age of forty-seven, was felt as a serious loss by the numerous circle of friends who so highly valued him. He was a Member of our Society since 1860, and in 1866 contributed an interesting paper on a journey he had made the previous year round the shores of Volcano Bay in the island of Yesso—a paper which excited an important discussion on the occasion of its being read,\* and was afterwards published in the 'Journal,' vol. xxxvi. Captain Forbes commenced his professional career as a Midshipman under Sir Everard Home, on the Australian Station. He commanded a gunboat in the Baltic during the Crimean War, and afterwards served in the China War as Lieutenant commanding the *Algerine*. After the conclusion of peace with China, he had scarcely reached home when the remarkable campaign of Garibaldi in Sicily and Naples excited his adventurous and generous spirit, and he threw himself with ardour into the daring operations of the revolutionary chief. He participated in the first action outside Palermo, and was the first to enter Naples, and bring to his chief the intelligence that the Royal troops had evacuated the city. These details, though not geographical, are necessary to repeat, in order to give an idea of the character and career of the man. Returning to England, he published an excellent account of the Garibaldian campaign, in a volume which had a considerable success. He subsequently visited Iceland, and published an account of his journey; after which he re-entered active

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\* 'Proceedings of the Royal Geographical Society,' vol. x. p. 170.

service as Commander of the *Curlew* on the River Plate, returning from this cruise just in time to accept the command, under the late Captain Sherard Osborn, of one of the vessels of the Expedition equipped for the service of the Emperor of China. During the Civil War in America he commanded a blockade runner, and performed wonderful feats of skill and daring in this hazardous school of seamanship. The war over, he entered the service of the ill-fated Maximilian in Mexico; and returning to England after the perils and sufferings of this period, he set off, in 1865, on a private venture of his own to Cochin China and Japan. Subsequently he was engaged in mercantile adventure in California and Nevada, and, returning to England, died at his residence in the Albany, on the 12th of May, 1876.

SIR J. W. KAYE, F.R.S.—This eminent official in the Indian Department of our Government was born in 1814, the second son of Mr. Charles Kaye, formerly Solicitor to the Bank of England. He was educated at Eton, whence he proceeded to the Royal Military College at Addiscombe, where he passed through the studies necessary to qualify him for military service in India. He served subsequently for some years as officer in the Bengal Artillery; but his ardent love of literary pursuits led him to resign his commission in 1841, and for some years he devoted himself to literature. In 1856 he entered the Home Civil Service of the East India Company, and when the government of India was transferred to the Crown, he was appointed to the Secretaryship of the Political Department of the India Office, succeeding in this post to Mr. John Stuart Mill. The responsible functions of this office he filled with much credit, until failing health compelled him to retire in 1874. He was created Knight Commander of the Star of India in 1871, and elected a Fellow of the Royal Society in 1866. To the general public he was better known for numerous important historical and biographical works relating to India which flowed from his pen, the most important of which were—‘The History of the War in Afghanistan,’ ‘The History of the Administration of the East India Company,’ ‘The Life and Correspondence of Lord Metcalfe,’ ‘A History of the Indian Mutiny,’ ‘The Life and Correspondence of Sir John Malcolm,’ &c. He was elected a Fellow of our Society in 1865, and died on the 26th of July last.

Professor WILLIAM HUGHES.—We have to regret the loss, since our last Obituary was written, of this most industrious and learned

Geographer, who died on the 21st of May, 1876. He was for many years Professor of Geography at King's College, and recently filled also the post of Professor of the same branch of learning at Queen's College. To the general public he was better known as the author of numerous Manuals on the subject which he had made the study of his life, and to the compilation and continued improvement of which, in successive editions, he devoted all the best years of his hard-working, well-spent life. The amount of research and painstaking required in the preparation of such a work as his 'Manual of British Geography,' must have been truly prodigious. Manuals compiled with so much industry and conscientiousness could not fail of being appreciated by the public; they therefore gradually made their way into some of our best public schools, and new editions were repeatedly called for, upon the last of which he was working at the time of his death. The following are the titles of some of his chief works:—'Maunder's Treasury of Geography'; 'Principles of Mathematical Geography' (1843); 'Manual of British Geography' (1851); 'Manual of European Geography' (1851); 'Manual of Geography, Physical, Industrial, and Political' (1860); 'The Geography of British History' (1863); 'Treatise on the Construction of Maps' (1864); 'Geography in Relation to History' (1870), &c.

The following Members have been also lost to us by death during the year, many of whom were distinguished in various walks of life, although not known as Geographers: Colonel H. R. Addison, Sir A. Bannerman, G. T. Brooking, Rev. J. Brereton, Francis Buckley, Edwin Brown, T. B. Baker, Edw. Beldam, Dr. L. Cape, H. Cope, C. H. Chambers, H. Collinson, J. Crowdy, Sir Edw. Cunyngname, Bart., J. Dickinson, H. J. Dunell, F. S. Dutton, J. Edward, H. Field, Col. W. F. Grant, I. Gerstenberg, Capt. J. T. Greenfield, Lieut.-Col. F. A. Gould, W. E. Heeley, E. J. Hutchins, A. B. Halloran, T. Hamilton, P. D. Hadow, A. Hector, T. A. Kjaer, G. Kenrick, Dr. R. P. Linton, Dr. A. E. Mackay, T. W. L. Mackean, T. Malby, G. Mathews, Rev. J. Ouvry-North, Capt. Oldfield, W. Phelps, E. C. Ravenshaw, J. Reeve, J. Reynolds, J. V. Shaw, Admiral Swinburne, Sir J. Stuart, Lord Sandhurst, Lord Sudeley, Major P. Swan, Lieut.-Col. G. Thompson, H. Thurnburn, C. Verrey, T. Wilson, W. C. Wentworth, and H. Waite.

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ADMIRALTY SURVEYS.\*—The year since the last Presidential Address has been marked by the return to England and the close of two Expeditions, which have rendered important services for the advancement of Geographical and Hydrographical science. The results of the deep-sea exploring voyage of H.M.S. *Challenger*, and the Expedition for discovery and research in the Arctic regions in H.M.'s ships *Aleut* and *Discovery*, have given fresh impulse, and rendered large additions, to several branches of scientific inquiry. Further, the professional skill displayed by the leaders and crews of these Expeditions, in conducting their ships under many hazardous conditions, and with perfect security, will form bright pages in the annals of our naval history.

Admiralty Surveys, both at home and in our Colonies, are with undiminished force making steady progress. Additions to the surveying ships-of-war on foreign service have been made by the appropriation of the steam-corvette *Faen* and the sailing-schooner *Alacrity*; the former for employment at the outset in the Red Sea and on the Zanzibar Coast, the *Alacrity* for the hydrographic development of the Fiji group and its countless coral reefs.

Notwithstanding these additions to the surveying force of the Hydrographic Department, it is found difficult to keep pace with the demands made in the interests of commerce for marine surveys, both in extension of imperfectly-known coasts, and for greater details to those already accurately charted.

*Shores of the United Kingdom.*—Staff-Captain Parsons, in H.M.S. *Porcupine*, has been engaged on the shoal-grounds between Yarmouth Roads and Dover; this included a re-examination of the Hewett and Cockle channels. From the continuous movements of the sands in these localities, frequent surveys are required in the interests of shipping. The shoals at the entrance of the River Thames have also undergone examination in extension of Captain Calver's former survey of 1862-3. Shoreham Harbour has also been re-surveyed.

In continuation from the preceding year, the survey of the Solway Firth, from the sea to the end of the navigation at Bowness railway bridge, has been completed by Staff-Commander J. H. Kerr, assisted by Navigating-Lieutenant Langdon. Marked changes in the channels and shoals over the whole area have taken place since the Admiralty Survey of 1837. This officer has also completed a survey of St. Tudwall Bay, a neighbourhood now rendered more

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\* By Captain F. J. O. Evans, C.B., F.R.S., Hydrographer of the Admiralty.

available for shelter by the recent admirable marking of its dangers and approaches by lights and buoys, under the direction of the Trinity Corporation.

On the east coast of Scotland, the bar of the River Tay has been surveyed in minute detail by Staff-Commander George Stanley, a necessity arising from changes which have taken place since the surveys of 1833 and 1866.

In Ireland, Staff-Commander Hall, with an assistant, has been engaged in surveying the upper part of the River Shannon from Wellesley bridge, Limerick, to Cains Island. Since the Admiralty Survey of 1841, changes have taken place in the bed of this river. The increased draught of ships visiting Limerick since the opening of the floating-dock has further rendered a re-survey on a large scale necessary.

*Mediterranean and Red Sea.*—Commander Wharton, late of the *Shearwater*, in his newly-commissioned ship the *Fawn*, with a strong staff of young surveying officers, and assisted by Staff-Commander Millard, resumed in the past autumn the examination in detail of the seaboard from the Damietta mouth of the River Nile to Port Said, and also re-sounded that part of its approaches in continuation of the survey of March 1875. In comparing the present condition of the Damietta mouth with that as charted in 1856, it is found that the sand-bars are considerably pushed forward, but retaining more or less of the former shape of the river's mouth; and that there is also a slight advance of the land. The mast of a vessel, wrecked and sunk on the bar about seven years since, is now considerably inside the western point of the river, showing an unusually rapid advance of the coast. Captain Wharton, however, observes that the sand-bars are daily shifting, and that it is probable an unusually heavy winter gale may from time to time wash away the accumulations of many years. Another interesting fact is given by Captain Wharton. At the time of the *Fawn's* visit it was the period of highest Nile. The water issuing from the Damietta mouth is then so charged with matter that it forms a species of breakwater to the shore to leeward, the wind being comparatively powerless to raise it into waves, and the swell coming from the northward being nearly entirely killed by it. When there was a heavy swell of a height of 6 feet from trough to summit outside the line of Nile water, inside this dirty water, and on the bar, no swell of any kind was visible. Locally, this is known as the Mishta season; and advantage is then taken to anchor trading-vessels close to the bar, in no more water than they draw.

With reference to Port Said, the soundings were found more uniform than in any of the previous surveys. This was accounted for by the season of the year. Previous surveys had been made in the spring, before the inequalities scoured out by the winter gales had time to settle. The shore-line at the western breakwater had advanced 105 feet since March 1875, an interval of nineteen months. The shore to the east of the canal-entrance, and near the eastern breakwater, is washing away.

Passing into the Red Sea, Captain Wharton defined some of the outlying dangers in the neighbourhood of the Suakim Islands and the opposite Arabian Coast; made a complete survey of the port of Jiddah, and then commenced the survey of the Massowah channel. This inshore route on the African coast, between the parallels of  $15^{\circ}$  and  $17^{\circ}$  N., is likely to be of considerable value. Under-powered and small steam-vessels experience difficulty, and of course detention, in making headway against the strong southerly winds which blow in the central part of the Red Sea south of the 17th N. parallel during the winter months. In the Massowah channel moderate winds and smooth water are experienced; the various islands and headlands on the passage serving as constantly recurring land-marks, and there is anchorage nearly everywhere.

*Mauritius.*—Although a skilful triangulation had been executed so far back as 1753 by the well-known Abbé de la Caille, and accurate maps of the island exist, the hydrographic features of this valuable colony have hitherto been very imperfectly rendered. It was accordingly arranged, in the interests of modern navigation, that a general plan of the shores should be executed on the scale of one inch to the nautical mile—the soundings being carried out to the 100-fathoms' contour-line—and that plans of the harbours should be made on suitable scales.

Navigating-Lieutenant Coghlan was selected for the duty; and this active and intelligent officer, with very limited appliances, has in the first year completed the survey of the shores of the northern and more important half of the island, with its approaches, together with Port Louis; and has examined also, to some extent, the Grand Port. Lieutenant Coghlan contemplates completing the service afloat by the close of the present year.

*Indian Archipelago and China.*—The *Nassau*, Commander Napier, with his efficient staff, has broken ground on the seaboard of China, at Haitan Strait and its neighbourhood. The chief mission of this party is to examine in detail the several dangers lying close

to the shore, discovered since the excellent preliminary surveys of Kellett and Collinson of the Royal Navy (1840-6), by the hugging of the land during the strength of the north-east monsoon of the numerous large steam-ships engaged in trade between the Treaty Ports.

Prior to taking up this work at the favourable season of the year, Commander Napier made an excellent survey of the Dinding Islands in Malacca Strait, and the intricate channels and anchorages between the larger islands and the mainland; connecting at the same time the mouths of the Perak river with this survey; further taking a line of soundings for telegraph purposes between Penang and Rangoon.

The *Nassau* performed, *en route* to Hong Kong, good service in Carimata Strait by accurately determining the position of several prominent islets and dangers on the southern limits of this highway to the China Sea; adding to the soundings, and charting one more unknown rock in the fair-way of navigation with as little as 9 feet of water over it.

*South-West Coast of Korea and Japan.*—Captain St. John and his effective staff, in H.M.S. *Sylvia*, have been engaged for some time making an examination of, and connecting trigonometrically, the many groups of islands extending far seaward from the south-west coast of Korea, and lying in the line of direct sea-communication between Japan and the northern ports of China.

Detailed surveys of Murray Sound and the Mackau group in this region were made, and in the latter a good anchorage for moderate-sized vessels was found. This haven (named by Captain St. John after himself) will in time doubtless prove useful to storm-bound mariners. Here, as on the mainland, according to the former experience of the officers of the *Sylvia*, the islanders (Korean) displayed unconcealed dislike to the presence of strangers, and it required both tact and forbearance to avoid open rupture in carrying out the useful service of charting the group.

The northern part of the Goto Islands—westward of Nagasaki—as also the Kuga channel through the central part of the group, have been surveyed in detail by the *Sylvia's* officers.

*Newfoundland and Labrador.*—The labours of Staff-Commander Maxwell and his party, in the hired steam-vessel *Gulnare*, are still divided between Placentia bay in Newfoundland and the N.E. Labrador coast. The latter can alone be examined in the middle of the summer season. Coast details in continuation of former

work has occupied the time, especially the development of Frenchman's Run, a channel of much value to the fishing fleet.

The early and later parts of the season have been spent in charting the West coast of Placentia bay, and the examination of several off-lying shoals, these proving a source of embarrassment to the telegraphic cable arrangements, from their hitherto uncertain position.

*Jamaica.*—Lieutenant Pullen, with his small party, in a sailing schooner, has completed in continuation a creditable survey of the south coast of the island included between Milk river and Luana point, with the extensive off-lying bank of soundings, and also executed an enlarged plan of the Black River anchorages. This energetic young officer is pushing his survey rapidly to the east end of the island.

*Western Australia.*—Staff-Commander Archdeacon and his party are steadily working along the inhospitable shores of this colony, triangulating and charting in detail its rugged and broken features. From Swan River southward round Cape Leeuwin, and thence to West Cape Howe, near King George Sound, the coast-line has been completed; the anchorages at Koombanah bay and in Géographe bay sounded over; together with the positions of the dangerous reefs northward of Cape Naturaliste, and the innumerable outlying dangers off the much-dreaded locality of Cape Leeuwin, accurately charted.

The surveying officers report that from Cape Naturaliste to Cape Leeuwin there are only a few scattered settlers; between the last-named cape and West Cape Howe the country near the coast is quite uninhabited, being almost a continuous forest, rendering the carrying out of the survey not only most laborious, but entailing hardships and privations of an unusual character. Staff-Commander Archdeacon and his party deserve much credit for the energy and endurance with which they have overcome so many physical obstacles, and given us at the same time accurate surveys.

*South Australia.*—Staff-Commander Howard, with two naval assistants, in the hired schooner *Beatrice*, has now completed in continuation the coast from Cape Catastrophe to the northern shores of Streaky bay, with the off-lying soundings.

The broken sea-board of this important colony has therefore (with the exception of about 450 miles in the neighbourhood of the great Australian Bight), now been charted in detail by Admiralty Surveyors.



*Victoria.*—The detailed survey of Banks Strait has been completed by Staff-Commander H. J. Stanley, cordially assisted by the Victorian Government. In addition, large-scale surveys of Waterhouse anchorage and the Bay of Fires on the Tasmanian coast have been executed.

*Queensland.*—The surveying party under Staff-Commander Bedwell have during the past year surveyed in comprehensive detail the FitzRoy river from its seaward approaches to the town of Rockhampton: the shoaler portions of the Mary river below Maryborough, over which dredging operations are contemplated; and also the small Noosa river in Laguna bay, north of Brisbane, in lat.  $26^{\circ} 24'$  s.

*Fiji Islands.*—Lieutenant W. U. Moore, in H.M.'s schooner *Alacrity*, has taken up the work among these Islands in succession to Lieutenant Dawson. His early duties were to survey Savu Savu bay in Vanua Levu, as also Nandi bay; both of these localities having been named as favourable sites for the proposed new capital of the Colony. It is now understood that Suva bay, surveyed by Lieutenant Dawson, offers superior advantages, and that the seat of Government will be removed thither from Levuka.

Lieutenant Moore has also completed the examination of Kandavu Island, and its encircling and outlying reefs extending to North rock on Astrolabe reef.

*Deep-Sea Exploring Expedition.*—In the Address of last year it was announced that the *Challenger's* labours were drawing to a close, and that her arrival in England might be daily expected. The proceedings were then brought up to the re-entry of the ship into the South Atlantic Ocean in January 1876, and the sailing from Monte Video towards the end of February, to complete sectional oceanic observations across to Tristan da Cunha.

In order to preserve a continuous record of the proceedings to those already rendered for the years 1873-4-5-6, the following sketch will bring these to their termination on the arrival of the ship at Spithead, and the paying-off of the *Challenger* and dispersion of her officers and crew in June of last year.

Between Monte Video and Tristan da Cunha twelve soundings with serial temperatures were obtained; making, with similar observations in the track of October 1873, fifteen determinations in this interesting region. In the western half of this traverse—on about

the 37th parallel of south latitude—the greatest depth was 2900 fathoms, and a bottom temperature obtained ( $31^{\circ}$  to  $31^{\circ}5$  Fahr.) colder than had been found in any part of the several oceans, except in the immediate neighbourhood of the Antarctic regions. The stratum of water below the temperature of  $32^{\circ}$ , further had an average height from the bottom of 2400 feet. In the eastern part of the traverse the depths were shallower, 1715 fathoms being the least found, the bottom temperature in this portion rising from  $32^{\circ}8$  to  $34^{\circ}7$ .

From Tristan da Cunha deep soundings and temperatures were obtained onward to Ascension, and thence to the Equator; there forming a junction with the position in  $3^{\circ}$  N., of August 1873, and the deep-sea results of that time. Between the above oceanic islands the depths varied from 2020 fathoms to the comparatively shallower water, 1240 fathoms, and the bottom temperature was in no case so low as  $35^{\circ}$ . Approaching the Equator from Ascension, the depths increased to 2350 fathoms, and the bottom temperature became colder, it having been recorded as low as  $32^{\circ}7$ .

A summary of the work done in the Atlantic Ocean tells us that serial temperatures were obtained at 125 positions, 82 of which were north and 43 south of the Equator. With these incomparable results, aided by the deep-sea sounding labours of the German ship-of-war *Gazelle*, combined with those of earlier American and English navigators—as also the work of the *Valorous* on her homeward voyage from attendance on the Arctic ships to Davis Strait—Staff-Commander Tizard, the Navigating and Chief Surveying officer of the *Challenger*, has constructed a diagram showing on a Mercator's chart the deep basins of the Atlantic Ocean, together with nine sectional diagrams of isothermal lines from the surface downwards, severally arranged in meridional, longitudinal, and diagonal directions; these, with a valuable monograph on Atlantic Ocean temperatures, form the 7th number of a series of Reports on the *Challenger's* proceedings, printed by the Admiralty during the voyage for limited distribution to learned Societies and others interested.

Before closing these brief records of the *Challenger's* labours, it may be of interest to place a few statistical details before the Society. The voyage round the world occupied 3 years and 172 days. The distance traversed was 68,890 miles: the highest southern latitude reached—a region of icebergs and pack-ice—was  $66^{\circ}40'$  S.; and although many intricate seas were traversed, and lands approached

which were scarcely known to the navigator, to the professional credit of all concerned the ship not once touched the ground.

To return to the great object of the *Challenger's* voyage: this, as is well known, was to investigate the physical and biological conditions of the great ocean basins. At intervals as nearly uniform as circumstances permitted, throughout the 68,890 miles traversed, 362 observing stations for these purposes were established. At most of these stations, in addition to the determination of the depths and temperatures, a sample of the bottom-water was procured for physical and chemical examination; a fair sample of the bottom-fauna was procured by means of the dredge or tow-net; and the fauna of the surface and of intermediate depths was examined by the use of the tow-net. Special care was taken for the preservation of these records. The collection of invertebrate animals is of great extent; and from most of the species being, it is understood, undescribed—and from the great peculiarity of the distribution of the fauna of the deep sea—this branch of inquiry, it is expected, will yield most interesting results.

The necessary investigations, and the preparation of a scientific account of the voyage, have been confided by Her Majesty's Government to Professor Sir Wyville Thomson, Chief of the Civilian Scientific Staff of the Expedition. This account, as estimated by Sir Wyville, will probably consist of a series of volumes, of which two will be devoted to a general description of the voyage, with such hydrographical details as may be necessary for the clear comprehension of the scientific observations, and to a full discussion of the general results, physical and biological; one volume to contain an account of the physical and chemical observations, with a special discussion thereon; and a further series of volumes (probably not less than six in number) containing a detailed account of the fauna, with plates illustrating the undescribed or imperfectly known forms.

*Miscellaneous.*—In addition to much useful Hydrographic information received during the year from officers of the Navy in different parts of the world, several commanding officers of the Mercantile Marine have contributed to our knowledge of the shores of China and Japan. Messrs. T. E. Cocker, of the Chinese gunboat *Ling Feng*; J. C. Pendered, of the Japanese Government steamer *Thabor*; E. M. Edmonds, of the Peninsular and Oriental Company's steamer *Malacca*; and G. C. Anderson, of the steam-ship *Conquest*,

deserve for their contributions special mention; their labours have been, or are, in course of publication. Sir Allen Young, and the officers of the Arctic yacht *Pandora*, extended our knowledge of the shores and anchorages at the entrance to Smith Sound.

Among other additions to Hydrography in the past year has been the discovery in the Atlantic Ocean of a comparatively shallow bank of soundings surrounded by ocean depths, 130 miles to the westward of Cape St. Vincent, in Spain. This was effected in the United States ship *Gettysburg*, Commander Gorringe, while engaged in carrying a line of deep-sea soundings, for telegraphic purposes, between Gibraltar and the Azores. Stormy weather and the advanced season prevented Commander Gorringe from making a full examination of the shoal area. The least depth obtained by this officer was 30 fathoms; but he was impressed with the belief that shoaler water would be found, and possibly that spots might exist dangerous to navigation. With this uncertainty pending, and the bank lying in the direct track between Lisbon and Madeira, the Admiralty caused an extended examination in March of this year to be made by H.M.S. *Salamis*, Commander F. W. Egerton, the despatch vessel attached to the Channel Squadron. This officer closely sounded the shoal-area by boats, finding not less than 20 fathoms; the *Salamis*, at anchor during the time of spring-tides, found the tides setting regularly to the north-east and south-west at the rate of  $1\frac{1}{2}$  mile per hour; abundance of fish were caught. The shape and area of the bank included in depths less than 100 fathoms is nearly circular, with a diameter of about 5 miles, and is situated between the parallels of  $36^{\circ} 29\frac{1}{2}'$  N. and  $36^{\circ} 34\frac{1}{2}'$  N.

The shoalest part, within the depths of 35 to 30 fathoms, appears to be a narrow ridge 2 miles in extent, running nearly east and west: the least depth of 30 fathoms being confined to a small patch in lat.  $36^{\circ} 31\frac{1}{2}'$  N., and long.  $11^{\circ} 35\frac{1}{2}'$  W.

The nature of the bottom at depths less than 50 fathoms was found to consist of rock and coralline matter; in depths exceeding 50 fathoms, pebbles, coralline substances, shells, and sand.

Beyond the depth of 100 fathoms the soundings increase rapidly. The depth of 1000 fathoms from the shoal-ground being about 5 miles in a northerly direction; 6 miles in a southerly; 13 miles to the westward; and 11 miles to the eastward. At 20 miles distant in a north-westerly direction, 2750 fathoms were found, and in a north-easterly direction 1640 fathoms.

*Summary.*—The Notices to Mariners on subjects of immediate

interest, such as the institution of new lights or alterations in old-established ones—similarly also with buoys and beacons—and especially the discoveries of new rocks or dangers, engage earnest attention: 167 of these notices, and 350 octavo pages of new hydrographic information of a less urgent nature, were issued during the past year,

Five volumes of sailing directions—including the second volume of the ‘Mediterranean Pilot;’ a second edition of ‘Directions for the Dardanelles, Sea of Marmara, and the Bosphorus;’ second edition of ‘West Coast of Scotland,’ Part II.; and 7th edition of Vol. I. of the ‘Australia Directory,’ have also been published.

In the chart branch, 62 new charts have been published, and 1896 charts have undergone correction; 180,000 copies have been printed for the general public and for the use of the Royal Navy.

ARCTIC REGIONS.—*The Expedition of 1875-6.*—The chief event in connection with our Society since the last Anniversary Meeting has undoubtedly been the return of the Arctic Expedition, under Captain Sir George Nares. The largest Meeting of the Session was that which assembled to welcome the Commander and officers of the *Alert* and *Discovery*; and we have this day sealed our approval of the geographical work accomplished by the Expedition, by conferring on its leader the highest honour we have it in our power to bestow. Having borne testimony in this emphatic manner to the value of the results achieved, it will be proper in this place to review briefly the connection of our Society with this great Expedition, and to show from the expectations our Council always entertained and expressed, that the objects have been in a great measure attained.

The Council have always thought that the objects of Arctic exploration, in these days, must be to secure useful scientific results in Geography, by exploring the coast-lines, and ascertaining the conditions of land and sea within the unknown area left unexplored by all previous Expeditions. We have also dwelt specially upon the importance of encouraging a spirit of maritime enterprise, and of giving worthy employment to the navy in time of peace—a truly national object, and one which, as the result proved, had as much influence in forming the decision of statesmen as the scientific results. It was with these views that Sherard Osborn, on the 23rd of January, 1865, read his first Paper at a Meeting of the Society, on the exploration of the North Polar Region. His proposal was that two steamers should be despatched to Smith Sound: that one

should winter near Cape Isabella; that the other should press up the western shore as far as possible; and that in the following spring, sledge operations should be directed over the unknown area. And again, in his Paper read April 22nd, 1872, he advocated the same route and a similar plan.

In consequence of this latter Paper, a Committee was appointed by the Council of the Geographical Society to consider the best means of bringing the subject before the Government: consisting of Sir George Back, Admiral Collinson, Admiral Ommanney, Admiral Richards, Sir Leopold McClintock, Captain Sherard Osborn, Dr. Rae, Mr. Findlay, and Mr. Markham. The Report of this Committee was unanimously adopted by the Council of the Society, on the 29th of April, 1872; and in the spring of 1873—the Royal Society having accepted our invitation to co-operate in these preliminaries—a joint Committee of the Royal and our own Society was appointed to prepare a Memorandum on the scientific results to be derived from the proposed Expedition. This Committee was composed of the same members as sat on the Arctic Committee of 1872, for the Geographical Society: and of Dr. Hooker, Mr. Busk, Mr. Prestwich, Dr. Carpenter, Dr. Allman, Mr. Evans, General Strachey, and Mr. Fergusson, for the Royal Society. In this Memorandum, dated June 1873, which was widely distributed, the scientific results were fully discussed in a series of paragraphs furnished by Dr. Hooker, Professor Allman, Mr. Prestwich, General Strachey, and Professor Newton; while the arguments derived from former experience and general policy were by Sherard Osborn.

On the 1st of August, 1874, Sir Henry Rawlinson and Admiral Sherard Osborn, accompanied by Dr. Hooker, had a very satisfactory interview with Mr. Disraeli, and on the 17th of November the Prime Minister addressed his well-known letter to Sir Henry Rawlinson, announcing that Her Majesty's Government had determined to lose no time in organising a suitable Expedition.

It is important that the objects of the Geographical Society in pressing this undertaking upon the Government should be kept in mind. The Council, in all its memoranda, abstained from setting forth the attainment of the highest possible northern latitude, and an attempt to reach the North Pole, as the main object of an Arctic Expedition. The object held steadily in view was the exploration of the largest area possible of the unknown region from a fixed base of operations, in order to secure useful scientific results. The course advocated was to navigate along a coast-line, to include the

passing of at least one Arctic winter in the scheme, and to look to sledge-travelling as the main instrument of discovery and exploration. Consequently the Smith Sound route was, for the attainment of the above objects in accordance with these rules, the best that could be selected.

The Arctic Expedition returned in October 1876, after having succeeded in crossing the threshold of the unknown region by the Smith Sound route, established a base of operations beyond it, and explored the unknown area from the base to the utmost extent possible with the means at their disposal. As far as popular objects were concerned, the *Alert* had reached the highest north latitude ever attained by any ship; she had wintered farther north than any ship had previously wintered, and Captain Markham had reached  $83^{\circ} 20' 26''$  N., a point nearer the North Pole than any human being had ever been before.

As regards geographical discovery and research, the results of the Arctic Expedition are recorded in the exhaustive Report of Sir George Nares, presented to Parliament, and in the two Papers he has read at Meetings of the Society, on December 12th, 1876, and March 26th, 1877. The Parliamentary Report, together with the copious details, illustrated by charts and sketches, relating to the sledge journeys, leaves nothing to be desired on the part of the geographer—nor, indeed, of the general reader—as descriptive of discoveries made of advanced Polar lands, of the energy, perseverance, and endurance displayed by officers and men on the several explorations, frequently under difficulties and hardships of the gravest character. And especially do these records show the bold and skilful manner in which the ships of the Expedition were conducted—the leading vessel to the highest latitude yet attained, and probably possible of attainment, by keel—and their safe return home from the hazards of ice navigation of no ordinary character, even for Arctic seas, with all appliances intact, and without accident to vessels or crews. It was found that the coast lines beyond Robeson Channel trended away to west and north-east, forming the shores of a frozen Polar Sea, and from the base of operations formed by the *Alert* in  $82^{\circ} 27'$  N. the members of the Expedition examined the coasts for a distance of 300 miles. Along the whole of this distance the ice of the Polar Sea was of the same character. Its existence was an unexpected and important discovery. This ice was found to be from 80 to 100 feet in thickness, formed by continual additions from above (due to the annual snow-falls),

which, by the increasing superincumbent weight, is gradually converted into snow-ice. Complete sections of the huge masses forced upon the shore were carefully taken, and they show the way in which the whole is formed, as well as its great age. These masses had been broken off from the large floes of ice, and were grounded in from 4 to 10 fathoms along the whole coast. The process of formation of the ancient floes resembles that of glaciers, and the masses thus grounded had been chipped off from them. They in no way resemble the mere piles of broken-up hummocks that are often found on other Arctic shores. They are, in fact, icebergs broken off from fragments of floating glaciers, and have therefore received the appropriate name of FLOE-BERGS.

The *Alert*, in September 1875, had thus reached an impenetrable sea of ancient ice, intervening between those lonely shores and the North Pole. It is not, however, one vast congealed mass never in motion, which would have been the case if it had been formed in a stagnant and confined sea. On the contrary, it is subjected to annual disruption, and to violent commotion during the summer months. Early in July the whole mass is in motion, driving backwards and forwards with the winds and currents, its main course being towards the east. The floes grind against each other and are broken in fragments, while, whenever the angular corners of any of the fields meet, there pools of water are formed. In September the frost sets in, and these pools and narrow lanes are frozen over with ice that becomes about 6 feet thick during the winter, but motion still continues, and ridges of hummocks are thrown up between the floes. The stillness of the Polar winter does not prevail until late in October or November. Then a new formation of ice commences, and goes on for seven months, which far more than counterbalances the decay during the summer.

Such is the nature of the great Polar Sea beyond the channels leading from Smith Sound, which was discovered by the Arctic Expedition of 1875-76. It is so totally different from the Polar pack met with north of Spitzbergen, that, with a view to that precision without which Physical Geography cannot make progress as a science, it was necessary that some distinctive term should be applied to it. This portion of the Polar Ocean was therefore named the PALEOCRYSTIC SEA, or sea of ancient ice: a name which has now been adopted by geographers, both in England and on the Continent.

Careful and diligent observation furnished some *data* by which



a judgment might be formed of the probable extent of the Palæocrystic Sea. It is certain that land was not near to the north, because hills were ascended to a height of 1500 feet and upwards on clear days, and there was not a sign of land. But there are other considerations all tending to the same conclusion. There are no flights of birds to the north, which certainly would be the case if there was land; and the only living thing that was seen on the Palæocrystic Sea, by the northern division of sledges, was a little snow-bunting that had strayed from the nearest shore. Further evidence is furnished by the fact that animal marine life almost ceases to exist in the ice-covered Polar Sea. The Palæocrystic Sea is a sea of solitude.

The great extent of this Polar Ocean is assumed on the above grounds. There is also evidence that it is a comparatively shallow sea. The northern division of sledges, at a distance of forty miles from the land, found bottom in only 72 fathoms; and between that point and the shore several huge floe-bergs were observed, apparently rising out of the centres of floes, which were probably aground. Another indication of the present shallowness of the Polar Sea is the general recent upheaval of the adjacent land. Drift wood was found far above any point to which it could have been carried by ice or water.

As regards the distribution of land and sea within the unknown area, and its general hydrography, the discoveries of the Expedition are important. And it usually happens that when a new geographical fact is revealed, through the labours of scientific explorers, it is found that it harmonizes with other isolated pieces of knowledge which previously stood alone, as it were, and were not intelligible without it; the geographical and hydrographical results of the Expedition are also most important, because they have a practical bearing on the general system of oceanic currents and of meteorology, and consequently form an essential part of a vast whole. Without a knowledge of the hydrography of the Polar Region, all the general theories of oceanic currents must be incomplete; and Arctic research is, therefore, necessary to a science which is of practical utility. But the Expedition brought home other results, which are certainly not less interesting than those discoveries which immediately concern the Geographical Society. Among these may be mentioned the examination into the geological formation of the whole coast line on the west side of the Smith Sound channels from Cape Isabella to Cape Union, as well as of the shores

of the Palæocrystic Sea on either side of Robeson Channel. Collections of rocks and fossils were made at every point, including a very complete Upper Silurian series, and the mountain limestone shells and corals of Cape Joseph Henry. But by far the most important geological discovery was that relating to the existence of tertiary coal in  $82^{\circ}$  N., and the former extension of miocene vegetation to that parallel. The Expedition also made an exhaustive collection of the biology of a region previously almost entirely unknown to science: the region north of the 82nd parallel, as distinguished from the Arctic countries to the southward. The whole *flora* of the new region has been brought home; and it must be remembered that meagre though this *flora* certainly is, Dr. Hooker has shown that it possesses special interest in connection with the remarkable distribution of American and Scandinavian plants. The zoology of the newly-discovered region has also been exhaustively examined, and very complete collections made as regards mammalia, birds, fishes, insects, molluscs, crustacea, echinoderms, and a vast number of microscopic forms. In physics a complete series of meteorological, magnetic, tidal and other observations, covering a year, has been taken at two stations.

As regards the conduct and management of the Expedition which secured these valuable results, the most essential object, and the crucial test of its success, is the attainment of a position as a base of operations beyond any hitherto discovered. To have brought a ship through the difficult channels leading north from Smith Sound, and to have found winter quarters on the open and exposed coast of the Palæocrystic Sea, protected only by grounded floe-bergs which might at any time be driven higher up or swept away, was in itself a great success. No other Arctic navigator ever forced his ships through such obstacles, and brought them safely back again; and this establishment of a base of operations within the unknown region called forth all the highest qualities of a commander—incessant watchfulness, great presence of mind, rapid yet cautious decision, and consummate seamanship.

Next to the establishment of a base of operations beyond any point previously reached, the most important preparation for exploration and discovery by sledges is the management of the Expedition during the long darkness of an Arctic winter, and the maintenance of the health and spirits of the men. The difficulties, in this respect, of the Expedition of 1875-76 were greater than any that had previously been encountered, because the winter was the

longest and the most severe, and the continuous darkness was the most prolonged that had ever been endured in the Arctic Regions. Moreover, the absence of the warming apparatus supplied to former Expeditions increased the difficulty of preserving health. When these special disadvantages are considered, the efforts of the commanding officers of the late Expedition to preserve the health and keep up the spirits of the men are deserving of high praise. When the sun returned, the scheme for exploration by sledges was matured; and early in April 1876, under difficulties, and exposed to an extremity of cold beyond anything that had been experienced in former expeditions, the sledging parties left the ships.

Owing to the Admiralty Instructions, it was incumbent upon Captain Nares to push his principal party due north over the Palæocrystic Sea, with the object of attaining the highest possible northern latitude. As there was no land, it was not possible to lay out dépôts, and all supplies, together with boats, had to be dragged on the sledges. The Admiralty had impressed upon Captain Nares (para. 15 of 'Instructions') that, in the absence of continuous land, sledge travelling for any considerable distance has never been found practicable. Yet, in order to attain the main object of the Admiralty, the attempt had to be made. The farthest north hitherto reached was on July 23rd, 1827, when Parry got to  $82^{\circ} 45' \text{ N.}$  But this was during the summer, and the work was done without the endurance of serious hardships, although the weights to be dragged per man were very great, namely 268 lbs. Captain Markham won the palm from Parry after he had held it for nearly forty-nine years. On May 12th, 1876, he reached  $83^{\circ} 20' 26'' \text{ N.}$ , in the face of hardships and difficulties without a parallel in the annals of Arctic sledge-travelling. For this great exploit our Council have awarded him, as you have already learnt, a special honorary testimonial.

Three other extended sledge parties were organized to secure the true objects of the Expedition, from the point of view of our Society, namely, the extension of geographical knowledge. One was to explore the unknown region to the westward of the base of operations to the farthest point attainable; the second was to press eastward along the northern coast of Greenland: and the third was to examine the deep inlet named after Lady Franklin, which was believed to be a strait. All did their work admirably, and extended their explorations to the utmost limit, in two sad cases beyond the utmost limit, of human endurance. They fully, com-

pletely, and with heroic self-devotion, fulfilled the objects which our Arctic Committee had prescribed, by exploring that portion of the unknown region accessible by the Smith Sound route to the farthest extent possible with the means at their disposal.

*Expeditions to the Obi and Yenisei.*—With regard to other parts of the Arctic regions, it is interesting to record the considerable additions that have been made during the past season to our knowledge of the estuaries of the Obi and Yenisei, and the neighbouring parts of the Kara Sea, by German and Swedish expeditions. The latter, under the leadership of the celebrated Arctic Explorer, Dr. Nordenskiöld, succeeded, as in the previous summer, in reaching the estuary of the Yenisei. The German party, consisting of Messrs. Finsch, Brehm and Zeil, equipped by the German North Polar Exploration Society, devoted itself to the examination of the isthmus separating the Bay of Kara from the River Obi. It had been previously stated by Captain Wiggins, who has devoted himself with great zeal and intrepidity to the exploration of a trade-route by sea to the Obi, that a practicable road might be found, by means of tributary streams, across this neck of land, thus materially facilitating the approach to the Russian trading centres in North-Western Siberia. The exploration last summer by the German *savans* above-named has, however, set this matter at rest for the present. Descending the Obi to Obdorsk, they made a gallant attempt to traverse the neck of land separating that part of the river from Kara Bay: the small rivers were navigated, with much difficulty, to their headwaters, and sledges were then employed in traversing the desert Tundra; but they were unable to reach the shores of the bay, and were obliged to return. The canalisation of the isthmus they consider impracticable.

RUSSIAN EXPLORATIONS.—The attempts to unite Western Siberia with Europe by the navigation of the Glacial Ocean form one of the chief geographical undertakings in Russia during the past year. But although the achievements of the Russian explorers, as well as those of Nordenskiöld and Wiggins, will enrich science by many valuable discoveries and interesting communications, it is doubtful whether they will, at all events for some time to come, be productive of real advantage to the country itself. And this may be said with equal truth of the recent relations between Western Siberia and China, undertaken with the view of establishing commercial intercourse with the inner provinces

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of the Celestial Empire. The Expedition of Lieutenant-Colonel Sosnoffsky left Kiakhta with the purpose, amongst others, of exploring the trade-routes from the tea-plantations to the Russian frontier on the Black Irtysh. It succeeded in accomplishing its difficult journey, and proceeded from Kiakhta to Peking, Shanghai, and Hankow, passing through the Great Wall by the westernmost gate, and returning across Mongolia to the Zaisan district. But when, shortly afterwards, a caravan, laden chiefly with corn for the Chinese troops, escorted by some Cossacks, was despatched in accordance with the promise of Tso, Governor of the provinces of Shen-si and Kan-su, the Chinese Government, in spite of its promises, and influenced by its usual suspicions, refused the Russian merchants admission to the provinces of Inner China. On this side, therefore, Russian trade cannot penetrate beyond Mongolia, where, at all events, it has not to compete with English goods.

But the question of laying a railroad to Siberia has made more progress, and a line starting from Nijny Novgorod, on the Volga, to Tiumen, on the Tura, has been, in principle, decided on. We have recently learnt, also, that the Emperor has finally sanctioned the construction of a line of railway from Orenburg to Tashkend—a great work long talked of, which, taking a circuitous course to avoid the steppe, will extend to a length of 1200 miles. On the other hand, internal communications, such as the construction of roads over the mountains to the frontiers of China and improving the navigability of rivers, have hitherto been unsuccessful, owing to the want of trained engineers. It is to this want of trained specialists in all branches of industry, no less than by the large number of its convict population, that the development of so rich a country as Western Siberia has been chiefly retarded.

While on the subject of Siberia, I would add a few remarks to those which have appeared in previous Addresses\* on the late Mr. Chekanoffsky's Expedition to the basins of the Yenisei and Lena rivers. From a sketch of the geographical labours of this enterprising and gifted explorer, who was removed by death while the results of his three years' travels were still in course of publication, I learn that the scientific results comprise, in the first place, 108 astronomical, and 57 magnetic observations; secondly, the cartography of regions hitherto comparatively unknown, viz. the great lake system between 67° and 69° N. lat.; the highlands, including parts of the basins of the Olonek, Vilui, Nijny Tunguska, and

\* See vols. xliv. xlv. and xlv. 'Journal of the Royal Geographical Society.'

Hatanga rivers; and lastly, the whole of the Olonek system, and the region to the east of the Lena. And in precisely similar way localities, concerning which we already possessed more information, are represented in an entirely different light: for instance, the Lena is now for the first time described in full detail; Lake Surung, together with the whole of the Vilui region, as well as the great bend of the Nijny [Lower] Tunguska, were  $\pm$  degrees of longitude out of their right position on our maps; and lastly, the earlier surveys of part of the Verkny [Upper] Tunguska, for an extent of 400 versts, were fully 70 compass degrees out of their proper bearings.

But Chekanoffsky's chief object was geology, and in his sketch of the composition of the strata along his line of route he shows that the River Nijny Tunguska, for some distance, flows through Silurian strata, and these are evidently associated with Devonian, and for a considerable distance with the Red Sandstone. Further down, this river flows through trap-rocks, its channel lying for a distance of about 1800 versts (1200 miles) through this igneous formation; but other strata occur with it, containing in some places coal, in others graphite, and these probably belong to the carboniferous measures, as indicated by the vegetable remains found in them. On approaching the Olonek, the trap-rocks still predominate, but before reaching the river, they give place in their turn to the Silurian, here unassociated with Devonian series. These occupy the whole extent of the Olonek Valley to the utmost limits of tree-growth. The valley of the Lena in its upper half is geologically composed of the same Silurian and Red Sandstone strata as are found on the upper course of the Nijny Tunguska. But in its lower half the Mesozoic formations are developed, extending northwards to the shores of the Glacial Sea. The most valuable results of these explorations are in Chekanoffsky's opinion the following:—

1. The discovery of an hitherto unknown region of eruptive rocks of vast extent, exceeding any hitherto known, and continuing through  $6^{\circ}$  of latitude and  $15^{\circ}$  of longitude.
2. The acquisition of new stratigraphical and palæontological facts to determine the question of the age of the Red Sandstone, a question more debated than any other connected with the geology of Eastern Siberia; and
3. The determination of the age of the Mesozoic formations of Northern Siberia.

But Chekanoffsky also formed valuable collections of animals and plants characteristic of the great tundras, besides making a vocabulary of the language of their Tunguz



inhabitants, and these results entitle him to rank as a worthy successor of Middendorf, who alone among men of science had traversed this region on his way to the distant North.

I have to record another loss among Russian Geographers in the untimely death at Vienna, on the 16th of April of this year, of M. Barbot de Marny, whose extensive travels in Central Asia have greatly contributed to extend our knowledge of the geology of the Aralo-Caspian basin, and especially of the region of the Amudaria.

Barbot de Marny enjoyed a world-wide reputation as a geologist. He worthily supplemented, and in some degree amended, the works of Murchison, Verneuil and Count Keyserling, particularly in the north-east and south of European Russia, and his "Sarmatische Stufe" of Southern Russia will remain a lasting memorial of his learning and scientific attainments.

I learn from Petermann's 'Mittheilungen' that among the most recent additions to the already large mass of information on the Geography of the Pamir is a map drawn by Jehandar Khan,\* the deposed ruler of Badakhshan, containing an itinerary from Ush in Khokand, across the Alai Plateau and trans-Alai Mountains, to Lake Kara-Kul, thence in a south-westerly direction to Shighnan (Shaghnan), passing through Vomar and Bir-pandj on the Oxus, before turning towards Chitral *via* Wakhan and Yassin. Another itinerary on the same map leads from Hissar *via* Kolab to Faizabad.

Another interesting itinerary, communicated by Mr. Veniukoff to the Russian Geographical Society, is from Aksu, in Eastern Turkistan, to Ladak. It is divided into 49 marches, making in all 1328 versts (about 885 miles). This itinerary was found in the archives at Omsk, and refers back to the year 1824.

Of more general interest is a Memoir by J. Moushkétoff on volcanoes in Central Asia.† The author reviews the earlier authorities on the subject contained in Carl Ritter's 'Erdkunde' and Humboldt's later writings, and after comparing these with his own observations on the Ili basin, concludes by denying the existence of active volcanoes in Asia, although he admits the occurrence of extinct volcanoes, such as Pe-shan, north of Kucha, and another north of Kashgar, recently discovered by the late lamented Mr.

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\* This chief is mentioned in Col. Montgomerie's report of a Havildar's journey through Chitral to Faizabad, in 1870. See 'Journal of the Royal Geographical Society,' vol. xlii.

† 'Bulletin de l'Académie Impériale des Sciences de St. Petersbourg.

Stoliczka. Amongst other geographical undertakings of Russia in Asia, I can only briefly refer to Captain Pévtsoff's astronomical and barometrical observations along the caravan routes from Port Zaisan to the Chinese town of Guchen; Potanin's explorations in the south-west spurs of the Altai, and the region around Kobdo; and Kostenko's reconnaissance in the Pamir, where Sir Douglas Forsyth and his party have done such good service in the cause of geographical research and exploration. Lastly, I would mention that Colonel Prejevalsky is reported to have succeeded in reaching Lob-nor, and to be exploring the mountains to the south of this lake. It is anticipated that he will return early in July, and we may then look for some interesting particulars of a region never before visited by modern European traveller.

The well-known philologist, Hunfalvy de Meo Koveshd, is at present travelling in Turkistan for the purpose of anthropological studies. Mr. Voïékoïff has communicated particulars of his travels in Japan in 1876, and Mr. Miklukho Maklay sends another, and a last instalment of his notes on New Guinea.

Two new scientific Expeditions, as Mr. E. Delmar Morgan (to whom I am indebted for this account of Russian Exploration) informs me, will probably shortly be organised by the Russian Geographical Society: the first, under Mr. Mainoff, will study the Finnish tribes living on the Volga: and the second is intended to explore the water-communications of Siberia, with the view of ascertaining the feasibility of opening a direct water-way between North-Western China and European Russia by Lake Baikal, the Angara, the Yenisei, the Ket, the Ob, and the Tobol.

INDIA.—*Indian Surveys*.—The first Report of the new Department of Indian Marine Surveys has been submitted by the Superintendent, Commander A. D. Taylor, late I.N., and has been deemed of sufficient importance and interest to warrant its being reprinted in this country as a Parliamentary Paper. The Report touches upon the period of absolute inactivity in Coast-surveying which succeeded the abolition of the Indian Navy in 1861. For ten years the wants of the Mercantile Marine frequenting the Indian ports were neglected by the discontinuance of those surveying operations, which had been one of the chief functions of the Indian Navy. In 1871, Mr. Clements R. Markham, C.B., our Secretary, drew the attention of the Duke of Argyll, then Secretary of State for India, to the pressing need of some organized agency for providing for

this end. The fact was, that since the execution of the surveys then in use, many of which dated from thirty to fifty years back, extraordinary changes had taken place in the configuration of the coast; lights, buoys, and beacons had been erected; and ports, of little or no importance then, had become regularly open to commerce. Many of the surveys of a century before had been mere preliminary examinations not to be compared with the rigorous Royal Navy surveys of the present day, carried out with steam-boats and trained officers.

After some delay, the Government finally took up the question in 1873, and requested that Commander Taylor should be deputed to India to advise them on the subject. It was on the 16th of July, 1874, that official sanction was given for the formation of the new Department called "The Marine Survey Department." Commander A. D. Taylor, late R.N., was created Superintendent, and six experienced Navigating Officers of the Royal Navy were lent by the Admiralty for service under him. Besides these, a few officers of the Bengal and Bombay Marines were engaged in India, and an experienced official of the Admiralty Hydrographic Office was created Superintendent of the Drawing and Compiling Branch.

The chief surveys executed by the new Department up to the end of 1876 comprise the following:—Kolachel Harbour and the Enciam Rocks in Travancore, Coconada Bay and the lower part of the Hooghly River, including the James and Mary Shoals, the approaches of the Rangoon River, Akyab Port and False Point anchorage. The Department sustained an unfortunate loss by the death of one of its Royal Navy surveyors, Lieutenant C. George, a young officer of promise, and son of Staff-Commander George, R.N., our Map Curator. During the spring of 1876, Commander Taylor made a tour of inspection along the Burmese coast, which resulted in the detection of many errors in the existing chart, and in a determination to have the important port of Amherst properly surveyed at the earliest opportunity. A valuable list of light-houses and light-vessels along the coast of British India has been compiled on the model of the Admiralty List; and Commander Taylor's Department has further proved its usefulness by rendering advice to Government on a variety of marine subjects.

The Great Trigonometrical Survey of India completed during the years 1875-6 an out-turn of 4182 square miles, while an area of some 9000 square miles was covered by secondary triangulation, 3500 square miles of it being closely covered with points for the

topographical surveyor. Topographical operations by the same departments have been conducted in Dehra Dun, including the Siwalik Hills, and Jaunsar Bawar, Kattywar and Guzerat; and the area achieved has been 1047 square miles on the scale of 4 inches to the mile, and 3629 square miles on the scale of 2 inches to the mile. Three separate surveys have been brought to completion; these being the Jodhpur Meridional series of principal triangles on the meridian of  $72\frac{1}{2}$ , running through the Jodhpur, Jesalmir and Bikanir States of Rajputana and Bhawalpur; the topographical survey of the beautiful valley of Dehra Dun, including its outlying subdivision of Jaunsar Bawar and the Siwalikh Hills; and the Ceylon Connecting Series, by means of which complete unity can now be introduced between the Surveys of Ceylon and India, and through which the recent telegraphic measurements in uniting India and Greenwich longitudinally will have established a similar connection for Ceylon. Spirit-levelling operations, chiefly in Cutch and Kattywar, have been carried over 421 linear miles, and three stations for tidal observations on the north shore of the Gulf of Kutch have been connected by levels; the result of the determination being to indicate that the mean sea-level stands progressively higher, as the tidal station is removed from the open-sea further up the Gulf. The usual activity has been shown in the computations and publications of the Department, the general Report of which has been issued by Mr. J. B. N. Hennessey, M.A., F.R.S., who officiated as Superintendent during the absence on furlough of Colonel J. T. Walker, R.E., F.R.S.

In connection with the foregoing should be mentioned the retirement from the service of Colonel T. G. Montgomerie, R.E., F.R.S., late Deputy-Superintendent of the Great Trigonometrical Survey, who, as a Gold Medallist of this Society, has a peculiar claim on our notice. Colonel Montgomerie's service in the Department, from the date of his entry thereinto in 1852, has been one of signal usefulness, and his labours in connection with the successful trans-frontier explorations, conducted by natives trained under his eye, will always be remembered.

In the Indian Topographical Surveys Section, nine parties were at work during the year 1876-77, and a highly satisfactory out-turn of 19,188 square miles was achieved, this being principally on the 1-inch scale. Two of the parties broke ground in the State of Mysore, where accurate surveys have for some time past been

needed. The large reductions which have been recently sanctioned in the Survey Department have already begun to have their effect in preparations for the absorption of two topographical parties during the present year; while in the Revenue Survey branch, eleven parties instead of fourteen have been employed during the season 1876-77, which is just coming to an end. The Government contemplate in this manner to bring the estimates of the whole Survey Department eventually down to 20 instead of 24 lakhs of rupees per annum.

In the Compiling and Engraving branches of the Surveyor-General's office progress has been made in the preparation of general maps of India, the Lower Provinces, Sind, Oudh and Assam. A map of Baluchistan, on the scale of 16 miles to an inch, has been published, and a new map of the countries between Hindustan and the Caspian Sea, on the scale of 64 miles to an inch, is under preparation. The natives employed on hill-etching continue to progress, but require the constant help and supervision of the European staff, a state of things which causes great delays in the work of the latter.

The total number of parties engaged on Revenue Surveys amounted to 17, and the total area surveyed was 11,175 square miles, on scales varying between 32 and 2 inches to a mile. Strenuous endeavours have been made to utilise the maps of the Bombay Settlement Surveys for incorporation as far as possible in the Topographical Survey-sheets, but, up to the present, the results have proved failures, owing to the great inaccuracy of the former.

A very interesting index-map has been published by the Surveyor General of India in his Report, showing the progress hitherto made by the different branches of the Survey Department towards the completion of a first survey of all India. Rajputana, Nepal, the North-West Provinces, the Konkans, and the whole Southern half of the peninsula are still conspicuously blank, but it must not be forgotten, that though not strictly and scientifically accurate, Atlas-sheets of these provinces *are* in existence. Indeed, the activity and energy with which the survey of our great Indian Empire has been pushed on for many years by the present accomplished head of the Department, deserves the warm recognition of geographers.

*Trans-Himalayan Explorations.*—"The Havildar," whose former remarkable journey into Badakshan, in 1870, was recorded by my pre-

decessor in the Address for 1872, has been again engaged in making a similar route-survey from Kabul to Bokhara. He left Peshawur on the 19th of September, 1873, with two companions, travelling in the disguise of a merchant, with about 300*l.* worth of muslins and cloths. Leaving Kabul on the 3rd of November, and crossing into Badakshan by the Sar-ulang Pass, about 12,000 feet above the sea, he arrived on the 19th at Faizabad, the modern capital of Badakshan, where he passed the winter. On the 19th of April, 1874, he set out from Faizabad with a stock of *churru*s (an intoxicating drug made from the hemp-flower) for sale, and reached the left bank of the Oxus, where he crossed the river on a raft made of inflated skins, the stream being 600 paces wide. The Oxus here separates the dominions of the Amir of Bokhara from those of the Amir of Afghanistan, and from this point upwards it is generally known as the Punjab. Next day the Havildar arrived at Kolab, a city of 600 houses, where he remained until the 25th of May. He then travelled along the right bank of the river into Darwaz, and arrived at Kila Yaz Ghulam, the frontier village of that little state, on the 9th of July. He was told that, from this point, one long day's journey would have brought him into Shighnan; but he was recalled by the ruler of Darwaz, and detained at its chief town of Wanj for three weeks. He was then told that he would not be allowed to continue his journey, but must return to Kolab; he consequently went back to Faizabad, and thence, by Balkh and Bamian, to Kabul, reaching Peshawur on the 11th of January, 1875.

Another of the native explorers, trained by the Trigonometrical Survey Department, a native of Peshawur, surnamed "the Mullah," accompanied the Havildar as far as Jalalabad, on his outward journey. He is described as a well-educated man, skilled in Arabic, and able, in his capacity of Mullah, to travel unquestioned in such dangerous districts as Swat and Chitral. He left Jalalabad on the 28th of September, 1873, crossed the Kabul River, and proceeded up the valley of the Kunar, of which he has given a very valuable description. He reached Chitral on the 31st of October, passing the winter there. On the 22nd of March he set out for the Baroghil Pass, which is believed to be the lowest depression in the chain that separates India and Afghanistan from Northern Asia. This pass forms the water-parting between the Sarhadd and Chitral Rivers; the Mullah crossed it, and reached Sarhadd, in Wakhan, on the 8th of May, 1874. He then proceeded over the Little Pamir

to Tashkurghan and Yarkand, and so by the Karakorum Pass to Leh. He merely made a route-survey with compass, without attempting observations for latitude or height above the sea, as detection would have been a most serious matter.

These two journeys, performed by "the Havildar" and "the Mullah," were complements of the work achieved by Captain H. Trotter, R.E., of the Great Trigonometrical Survey, who accompanied the Mission of Sir Douglas Forsyth to Kashgar as Geographer. A few words regarding the geographical work performed on that Expedition by Captain Trotter will be necessary in this place. On his outward journey he made an interesting boat-expedition on Pangong Lake in October 1873, obtaining soundings of this elevated sheet of water; and surveyed the routes between Ladak and Eastern Turkistan. From Kashgar he made important explorations to the north as far as the Chatyr Kul. He then proceeded on his important journey, by way of Tashkurghan, to the Pamir Steppe, where he obtained a complete set of astronomical observations, and was thus enabled to fix the principal positions along the line of march with considerable accuracy. In this journey Captain Trotter started from Kashgar on the 17th of March, 1874, accompanied by Dr. Stoliczka, the Geologist, passed through Tashkurghan, and reached Panjah in Wakhan. Here he despatched his assistant, Abdul Subhan, to explore the course of the Oxus from this point in the direction of Kolab. He followed the river for 63 miles to Ishkashim, thence, turning northwards, he continued his journey along the river-bank for nearly 100 miles, passing through the districts of Gharan, Shighnan, and Roshan—countries which have hitherto been known to us hardly even by name. He describes the famous ruby-mines, and gives many particulars respecting the countries of Shighnan and Roshan. The Munshi Abdul Subhan succeeded in reaching a point very near to that at which the Havildar, coming from another direction, was obliged to turn back. Captain Trotter left Panjah on the 26th of April, 1876, and marched up the northern branch on to the Great Pamir, reaching the west end of Wood's Victoria Lake, the source of the Oxus. Captain Trotter's valuable Report has thrown a flood of light on the geography of the Pamir and of Eastern Turkistan, and it is gratifying to find that his determination of the position of the Victoria Lake is practically identical with that of Lieutenant Wood.

The reductions of the astronomical observations and the com-

putations of heights were all made in the office of the Superintendent of the Great Trigonometrical Survey; and, among other results, a series of most valuable maps has been prepared. For Captain Trotter has not only worked out his own observations, but has also reduced those of the Havildar and Mullah, as well as those of the Pundit, Nain Singh, whose recent very remarkable journey through Tibet earned for him the Patron's Royal Medal, which has been this day publicly awarded. These native explorers did good service in the field, but, for the resulting narratives and maps, Geographers are indebted to Captain Trotter, as they were for the results of former journeys by native explorers to Colonel Montgomerie.

Regarding Nain Singh, the most distinguished of these native explorers, an account of whose latest journey, from the pen of Captain Trotter, was read before us at our last Meeting. I may add that his training as a traveller and topographer had extended over thirty years. His first experience was gained in the service of those two eminent and scientific officers, Richard and Henry Strachey. In 1856 and 1857 he was employed by the brothers Schlagintweit, whilst they were engaged in carrying on their magnetic and other observations in Ladakh and Kashmir. After some years' interval, during which he was usefully occupied in education as Head-master of a Government-school in his native district of Milam in Kumaon, he was, in 1863, taken into the employment of the Trigonometrical Survey, at the instance of Colonel Walker, and trained as an observer for topographic work in the countries beyond the Indian frontier. Since then, he has carried out with patience, intelligence, and perfect success, and at the peril of his life, a number of important Expeditions.

In 1865-66, he made his first important essay in exploration by his celebrated journey from the capital of Nepal to Lhasa; and thence he ascended the whole course of the Great River of Tibet to the region of Mansarowar Lake, a space of 10 degrees in longitude, and back to India. Though Lhasa had been reached two or three times at great intervals, during the two preceding centuries, by European travellers, none of them were practical Geographers, or had left us any geographical data; whilst the value of the observations by Chinese or Tibetan employés of the Jesuit Fathers, which formed the basis of this part of D'Anville's Atlas, has always been subject to great doubt. Nain Singh's determination of the true position of that celebrated city, as well as that of its approximate altitude above the sea, was therefore, practically, the first.



But, besides this, his elaborate route-survey of new country extended to some 1200 miles, his observations for latitude fixed that of 31 places, and those for altitude gave the approximate height of 33. He brought back, in addition, a very intelligent and interesting Diary, of which the substance is given by Colonel Montgomerie in the 38th volume of our Society's 'Journal.' Every means of judgment and comparison that could be applied resulted in showing that the Pundit's observations were most careful and trustworthy, though often made, as may be conceived, under circumstances of extreme difficulty, and straining ingenuity to obtain opportunity for making them at all.

For this great journey and its results, the Pundit received a Gold Watch from our Society in 1868. It cannot be said that his *name* became famous, for his name was necessarily suppressed, and unknown till recently, even to our Society. But, under the title of "The Pundit," his reputation spread over Europe.

In 1867, Nain Singh, with two comrades, made a second valuable journey on the Tibetan Plateau, in the vicinity of the sources of the Indus and Sutlej, and beyond them. Of this journey, also, the narrative, published in the 39th volume of our Society's 'Journal,' is full of interest.

Leaving minor services unnoticed, I pass on to the Pundit's crowning work as an explorer. Having accompanied Sir D. Forsyth's Mission to Kashgar, in 1873, without finding opportunity for detached employment, on the return of the party to Ladak he volunteered to go on a fresh journey of exploration. This journey, if not quite so important as that which earned his first fame, was over a field even yet more arduous, and less known. His route lay from Leh to Lhasa, by a line further north than any previously known, and, in fact, across that part of the high plateau of Tibet which is almost a blank in our maps. In the course of his journey he discovered an extensive series of lakes and rivers, as well as a vast snowy range to the north of the Tibetan course of the Brahmaputra.

His stay at Lhasa was cut short by circumstances of danger, and, after having determined the course of the Brahmaputra to a point very much lower than any that had yet been ascertained, he struck across the Himalaya southward, and entered Assam by the Tawang Pass, a route hitherto quite unexplored.

The total length of this journey from Ladak to the frontier-post of Assam was 1319 miles, and about 1200 miles of this lay through

what may most justly be called *terra incognita*. His observations for latitude and longitude were more numerous than ever. This great and toilsome feat appears to have closed the Pundit's career of exploration. Though not far advanced in years, his constitution is stated to be worn out, and his sight impaired by protracted exposure and incessant observation, in those harsh climates and at those vast altitudes. Such are the achievements which our Society has desired to recognise by its Medal.

NEW GUINEA.—An important journey in the interior of New Guinea has been performed during the past year by Signor D'Albertis, the well-known Italian naturalist whom my predecessor mentioned in the last Anniversary Address as having accompanied Mr. Macfarlane, in the London Missionary Society's steamer, on his voyage up the Fly River. On his return from that preliminary journey, Signor D'Albertis visited New South Wales, and was there furnished, by the liberality of a number of wealthy residents of Sydney, with the means of undertaking a further exploration of this greatest known river of New Guinea. A small steam-launch, named the *Nera*, of only 12 tons burthen, was provided for him, and leaving Sydney on the 20th of April, 1876, he commenced his ascent of the river towards the end of May, with a crew of ten men, three only of whom were Europeans. The journey up the stream was continued with varied adventure, but without serious accident, until the 28th of June, by which day he had reached a point in s. lat.  $5^{\circ} 30'$  and e. long.  $141^{\circ} 30'$ , about 500 miles from the mouth, following the windings of the river, a distance far exceeding that attained by Mr. Macfarlane in the *Ellangowan* in the previous year, which was only 160 miles. At the farthest point reached, Signor D'Albertis reports the Fly River to be in some places only 25 or 30 yards wide, and very shallow in places; indeed, it was owing to the stream in dry weather being too shallow for his little launch, which repeatedly grounded on gravelly banks, that he was forced to abandon his enterprise; his intention, at starting, having been to cross by land to the opposite northern coast of the island, should the river prove navigable to a distance of not more than 200 miles from the coast. The navigability ceased, however, at 400 miles from the northern side, and the land journey had to be abandoned. The rapidity with which the height of the water rose and fell, according as the weather was rainy or dry, shows that the traveller could not have been very far from the sources of the stream; and the swiftness of

the current after heavy rain was one of the chief difficulties he had to overcome in steaming against it. The anxieties and labours of the navigation, and the impassable nature of the dense forest which clothes the banks of this great river, prevented Signor D'Albertis from adding so largely as he had expected to his natural history collection, and the same causes prevented his making any geographical *reconnaissance* beyond the immediate banks of the stream. He endeavoured to get views of the country by ascending the small eminences accessible from the banks; but at the point where he turned back no high land was in sight, the highest hills observed around averaging only from 300 to 400 feet. But lower down the river he discerned from the top of a hill, 250 feet high, some very high mountains at a distance estimated at 50 or 60 miles. As far as native population is concerned, Mr. Macfarlane's experience appears to have been confirmed, namely, that it is only the broad reaches near the mouth of the river that are at all well peopled. Beyond 100 miles, native houses and natives seem to have been very rarely met with, and the natives in almost all cases forsook their houses or their villages on the approach of the strange visitors.

In April of last year, Mr. Macfarlane made an interesting voyage in the *Ellangowan* steamer from Port Moresby to China Straits and Possession Bay, at the south-eastern extremity of New Guinea, and made some discoveries of islands and harbours in this varied and picturesque region, which will form a valuable supplement to the result of Captain Moresby's memorable survey. The Rev. Mr. Lawes, an observant and zealous member of the London Missionary Society's Mission, takes an active part in these explorations, which are being undertaken with a view of ascertaining the best sites for Mission stations in New Guinea. He accompanied Mr. Macfarlane to China Straits, and has recently communicated an account of a subsequent visit to Point Hood, in the neighbourhood of which he discovered a fine river, 100 to 150 yards wide, which has its source on the slopes of Mount Astrolabe.

AUSTRALIA.—Mr. Ernest Giles, whose remarkable journey through the interior of Western Australia, from east to west, was recorded in the last year's Address, has since followed up his success by re-traversing this inhospitable desert from west to east, in a more northerly latitude than his previous route. Leaving the coast at Champion Bay in March 1876, he crossed the watershed of the Murchison and other rivers, and reached the head-waters of the

Ashburton in about lat.  $24^{\circ}$  s., whence he struck across the desert, passing a little to the south of Lake Amadeus, and reaching the line of overland telegraph at Mount O'Halloran. His line of march lay on the average about a degree and a-half to the north of Forrest's route.

NORTH AMERICA.—The surveys undertaken by various official departments of the United States continue to afford important contributions to our knowledge of the geography of North America; and, in connection with the purely geographical portions of these explorations, it is especially noteworthy that Transatlantic Government advisers are conspicuous for the breadth of their views in scientific matters, as mere triangulation and mensuration operations form but a small part of the published results, which include original Papers by competent authorities on the geology, palæontology, meteorology, ethnology, philology, zoology, and botany of the districts traversed.

Professor Hayden's Report of his operations in Colorado, published during the past year, is probably the most exhaustive of these surveys. The entire circuit of Colorado has now been made by his parties, and the altitudes fixed of the highest peaks of the Rocky Mountains (Blanco Peak, 14,464 feet, being found to overtop all the rest). The topographical portion of this Report is comparatively small; but the accumulation of facts in every ancillary branch of science is, as usual, astonishing, especially when it is remembered that this profusely-illustrated volume (of some 500 pages) is but one of a series issued as fast as circumstances will permit by the office of the Geological and Geographical Survey. This department has in addition published various separate parts of its "miscellaneous publications," containing much local geographical matter, and of its 'Bulletin,' of which the second volume is now well advanced; it has also recently issued three thick 4to. volumes on Palæontological and Natural History subjects connected with the survey, and all illustrated by very numerous plates and maps. Besides these, the special work of the survey has resulted in a considerable advance in the progress of the Physical Atlas of Colorado, of which, according to the President of the American Geographical Society, 6 sheets, comprising some 70,000 square miles, will be issued shortly.

In connection with these operations, Professor Powell has surveyed 7000 square miles of the east, and 4000 square miles of the

south-west and south-east of Utah, resulting in an accurate knowledge of the small capabilities of that district for agricultural purposes, owing to the slight rainfall, and of its rather more promising mineral resources.

Lieutenant Wheeler, of the Engineer Department, United States Army, has continued his surveys west of the 100th meridian, in Nevada, New Mexico, and California, traversing 25,000 square miles, of which 9000 were in New Mexico, south-east of Santa Fé. His special aim appears to have been the investigation of the practicability of diverting the River Colorado so as to irrigate the desert lands of South-East California; and he appears satisfied that a canal could be constructed by which 1600 square miles could be flooded. Thirteen atlas sheets of this survey have now been issued, on scales of 8 miles and 4 miles to the inch, covering a large part of Nevada, Utah, Arizona, New Mexico, and Colorado. Lieutenant Wheeler's general Report is of a very comprehensive nature; and he has also issued two thick 4to. Reports on the geology and zoology of the survey, with many coloured plates, maps and photographs.

An accurate survey of the great North American lakes has been carried on by General C. B. Comstock, of the United States Engineer Corps; in the course of which the precise elevations of Ontario and Erie have been defined. Accurate positions have also been determined for each of the West Indian Islands by the Hydrographic Bureau; the coast survey of the Gulf of Mexico has been continued; and the continental triangulation has been pushed eastward from the Pacific coast ranges to the Sierra Nevada.

In referring, however briefly, to the geographical work of our Transatlantic brethren, it must be considered a fitting opportunity to offer our congratulations to the American Geographical Society, which, incorporated in 1852, has now fully attained its majority; and the occasion is the more appropriate, as the Society has recently acquired a new and commodious home, for which it is indebted to the public spirit and liberality so characteristic of American citizens. Under the able direction of its distinguished President, Chief Justice Daly, whose eloquence and heartfelt regard for our favourite science cannot fail to have impressed his hearers during his late visit to this country, the American Geographical Society now numbers 1750 Fellows, and possesses a geographical library of some 10,000 volumes and a large collection of maps, &c.

Geographical operations on a large scale have been engrossed by the State in America; but the numerous and valuable papers con-

tained in the 12 volumes of 'Proceedings,' 'Bulletins,' and 'Journals' issued by the Society since 1852, sufficiently attest the vitality of Geography in the country at large.

**SOUTH AMERICA.**—Four papers descriptive of travel and research in remote and little known parts of the interior of this continent have been contributed to the Society during the year. Two of these, viz., Mr. Bigg-Wither, "On the Valley of the Tibagy," and Mr. Wells, on his journey from the Rio St. Francisco to the Upper Tocantins, will appear in our 'Journal,' with original maps furnished by the authors. A third paper, containing accounts of the remarkable journey of Mr. Alfred Simson across the dense forests of Ecuador, from the Pastaza to the Napo, and of his voyage of 1200 miles up the River Putumayo, will appear in the next number of our 'Proceedings.' The fourth is entitled, "Notes on Bolivia, to accompany original maps presented to the Royal Geographical Society," and is written by Mr. Musters, who distinguished himself a few years ago by his adventurous journey through Patagonia. All these papers will aid materially in filling up the still numerous gaps in our knowledge of this great continent, and supplement the work that is being carried on by the different governments.

**AFRICA.**—Africa has been the subject of discussion at four out of fifteen meetings held since our last Anniversary. The following papers have been read on this inexhaustible theme :—"The District of Akém, West Africa," by Captain J. S. Hay; "The Khedive's Expeditions to the Lake Districts," by Colonel Gordon, R.E.; Gessi's "Circumnavigation of Albert Nyanza;" and "The Livingstonia Mission at Nyassa," by Mr. Young; besides which numerous announcements have been made regarding other expeditions. We have also seen, in the columns of the 'Daily Telegraph,' the graphic letters of Mr. Stanley, the Correspondent of that Journal and of the 'New York Herald,' in Central Africa.

*Colonel Gordon's Expeditions.*—Under the instructions and personal superintendence of this officer, a complete scientific survey of the Nile has been made, commencing at Khartum, and ending at a point 40 miles distant from the northern end of Victoria Nyanza—a survey altogether of 1500 miles of river. Three officers of our Royal Engineers, with M. Gessi, have accomplished this, namely, Colonel Gordon and Lieutenants Watson and Chippendall. The "suds," course, current, width of the river—the rocks, rapids, and

nature of the country—have been laid down with minuteness, and two maps, on the scale of 35 miles to an inch, have been prepared for our Society from the original drawings of the above officers. These maps will remain as standard references.

Romolo Gessi has circumnavigated the Albert Lake with two iron boats built by Samuda Brothers, and states it to be 141 miles from north-east to south-west, and from 40 to 60 miles across. Leaving Dufli by boat on the 7th of March, 1876, he arrived at the mouth of the Lake on the 18th of March. The slow progress up this part of the river he attributed to contrary winds, incessant rain, and river-currents. The distance is 164 miles, along a deep, broad, navigable river, exceeding 700 yards in certain places, with a large population and a productive country on the western bank. From the mast-head of his cutter-rigged boats he observed hills and cliffs in the distance. On the shores of the Lake, forests of ambatch were of frequent occurrence. The people on the western shore were not friendly, sounding their war-drums and carrying their property away; however, M. Gessi was able to hold conversations with a few natives, the result of which seemed to prove that he had reached the farthest extremity of Albert Lake, and that there is no river feeding its southern extremity. At the same time, the mountains which he saw on either side of the Lake appear not to meet at the south end, and there may exist a passage for water to the south, though it was not observed, from the quantity of ambatch growing there.

M. Gessi remained on the Lake from the 18th of March till the end of April; a period of stormy equinoctial days, for he experienced constant rain and high winds. He has proved without a doubt that the Nile descends from Victoria Nyanza, enters the Albert Lake, and flows from it, at fourteen miles farther north, to Dufli; thus setting finally at rest the question of the direct connection of the Nile with these great Lakes. This question was rashly disputed by Dr. Schweinfurth (see President's Address of last year), although maintained by the late Captain Speke, and confirmed by Sir Samuel Baker. From the smallness of his escort, and the uncertain character of the people, M. Gessi did not examine the interior of the country, neither could he closely observe the streams flowing into the Lake on the eastern and western shores, but he reports several waterfalls and bays, where the colour of the water indicated the proximity of considerable streams.

Carlo Piaggia accompanied M. Gessi from Dufli to Albert Lake

in 1876, thence he proceeded alone up the Nile, and examined the new Lake, or back-water of the Nile, discovered by Colonel Long, near M'rooli. This has since been visited by Colonel Gordon himself, who has sketched its outline, as far as he observed it, on the map presented to the Society, which is published in the present volume of the 'Journal.' Respecting other travellers in this part of Africa, I may mention the following:—Signor Marno, after endeavouring to push south to the Balegga Mountains had returned to Egypt. Mr. Lucas intended to have proceeded to the head-waters of the Congo from Gondokoro; but severe illness prevented this, and the unfortunate traveller died on his way to England, as I have had occasion to relate in the Obituary notices at the commencement of this Address. Dr. Schrietzner (Emin Effendi) had visited King M'tesa of Uganda, was well received, and confirmed the previous observation of Mr. Stanley that the King was favourable to Christianity.

The Khedive of Egypt has recently given to Colonel Gordon supreme command over all the Soudan, from the second cataract, including Khartum, to the Equatorial region, with the view of suppressing slavery and developing all lawful commerce. He has appointed him to negotiate a peace between Egypt and Abyssinia, and with this view Colonel Gordon has been at Mas-sowah for some time; but this object is not accomplished, and we hope to hear of his having taken up his Governor-Generalship of all the Soudan.

General Stone, the chief of the general staff at Cairo, has kindly reported to our Society the various reconnaissances which have been made under his orders and those of Colonel Gordon in Egyptian territory; the most notable of which are:—Reconnaissances of country adjacent to the White Nile, by Colonel Long; Kordofan, &c., by Colonel Colston and Major Pemberton; Darfur, &c., by Colonel Purdy. Botany of Kordofan and Darfur, by Dr. Pfund. Topography and geology, by Mr. Mitchell; besides surveys, soundings, &c., by numerous other officers of the Egyptian staff.

*Stanley's Expedition.*—The Address of last year left Mr. Stanley to explore the then unknown south-western corner of Victoria Lake, between the Kitangule River and Jordan's Nullah of Speke. He had discovered the Shimeeyu River, which was "considered the true source of the Nile—that is, the most southern feeder of Victoria Nyanza;" but his recent letters inform us that a still more important river, the above-named "Kitangule," now claims



this honour. Mr. Stanley has visited the Albert Lake, and circum-navigated Lake Tanganyika.

Between July 1875, and August 1876, Mr. Stanley traversed by water, or on foot, from 1200 to 1500 miles; that is to say, he made about 4 miles daily, inclusive of halts, which is unusually fast travelling in the interior of Africa. Since his letter of the 15th of May, 1875, alluded to in last Address, the following have been published, giving detailed accounts of the countries he has visited:—Dated 29th July, 1875; 15th August, 1875; 18th January, 26th March, 24th April, 7th, 10th, and 13th August, 1876.

Pocock's letters are dated as follows:—14th August, 1875; 18th April, 1876. Ujiji, 21st July, 1876; 23rd August, 1876.

Stanley's letter from the Island of Bambireh, Victoria Nyanza, describes to us, with a map, the south-western corner of the Lake. Here are figured thirty-eight islands, from 1 to 10 miles from the shore; and the largest of them, Bambireh and Romeh, 12 miles in length by 2 or 3 in breadth. Two soundings appear upon the map, near Alice Island; the one next the shore is 166 feet, and the other, 15 miles to the south-east, is 338 feet; showing that this lake is navigable for any ship afloat. Having returned to his head-quarter camp at Kagehyi, he again crossed in a north-westerly direction to Dumo, in Uganda territory, and proceeded under a Waganda escort to explore the country between the Lakes Victoria and Albert. On entering Unyoro territory the people naturally were not friendly to Waganda soldiers, and Mr. Stanley had no opportunity of navigating the Albert Lake, through the timidity of his Waganda, who feared the dense population of Wanyoro. But he reached a bay of the Lake, which he named "Beatrice;" and, compelled to give up all hope of navigating it, he turned his attention to the south, and after several days crossed the River Kitangule, for the Arab settlement of Kufuro, in Karagweh. Mr. Stanley's opinion of the Kitangule Kagera is as follows:—"While exploring the Victoria Lake, I ascended a few miles up the Kagera, and was then struck with its volume and depth; so much so, as to rank it as the principal affluent of the Victoria Lake. In coming south, and crossing it at Kitangule, I sounded it, and found it 14 fathoms, or 84 feet deep, and 120 yards wide." This river will be recognised as the same which was crossed in 1862 by Captains Speke and Grant, and which they reported as a majestic navigable river from the Akenyara Lake.

While under the kind care of King Rumanyika, of Karagweh, Mr. Stanley made many important journeys to the west and south of the kingdom, visiting this great Lake district, and region of conical mountains and hot-springs, full descriptions of which I must ask you to refer to in his graphic letters. From here he traversed the districts of Western Unyamwezi; and we next find him on the 27th May at Ujiji. After a fortnight's arranging, Mr. Stanley left his heavy baggage in charge of Pocock on the 11th June, and proceeded to circumnavigate the Tanganyika Lake for fifty-one days. He estimates the Lake to be 800 miles in circumference, and 19 miles longer than Commander Cameron reckoned it. The Lukuga Creek, of Cameron, was examined during four days. The broken cane in the bed of the creek denoted to Mr. Stanley that any water must flow into the Lake, and not out of it; and he considers that the Lukuga has never been an outlet, and is not at present one, but that it will be the "waste-pipe" of Tanganyika in a few years, when the Lake begins to overflow. He tells us that Mr. Cooley's idea of there being a connection between Tanganyika and Nyassa Lakes is as absurd as Livingstone having separated Liemba from Tanganyika, Baker having married the Albert and Tanganyika, or Speke having made an island of a promontory (Ubwari). Mr. Stanley raises an interesting question as to the name and derivation of the word Tanganyika, saying that travellers have fallen into mistakes through the circumstance of the name of the country being applied to the Lake. At Liemba the Lake is not called Tanganyika, or *vice versâ*. The derivation of the word, according to Mr. Stanley, is "Plain-like Lake;" but this is not accepted as the true interpretation. Nyika is used as a proper name in Africa, and as portion of one, as Rumanyika; also, it is applied on the native routes west of Bahringo by the Rev. T. Wakefield as Mtanga-nyiko, which undoubtedly implies a swampy region. It signifies the floating water-plants, which produce edible roots—the "Singhara" of India, *Trapa natans*; and from the fact that this plant exists plentifully in Africa, and that quantities of floating vegetation were seen by the late Dr. Livingstone opposite Ujiji, it may be taken as the more probable interpretation of the two, namely, from *Tanganya*, to gather; and *Nyika*, (?) nuts: that is, "Tanganyika," meaning "collection of water vegetation," or "the habitat of the water-nut."

Mr. Stanley writes of "my discovery of the new lake and river," which he ventures to name the "Alexandra Lake and River." He

tells us that "he could not see this lake from his mount of observation because the Mountains of Ugufu intercepted all view of it; but his guides assisted him to understand the position of the Lake." This water, we are told, has three outlets—two flowing to the east towards Kitangule, and the third to the south, joining the Ruzizi Lake, which is made to discharge to Lake Tanganyika. This requires inspection, which we hope will soon be made by the Mission party who have proceeded to Karagweh; and if a reference be made to Speke's map in vol. xxxiii. of the Society's 'Journal,' this Lake Akenyara, which Mr. Stanley proposes to name Alexandra, will be found laid down 27 miles by  $4\frac{1}{2}$ . The total length of this river is 200 miles according to Speke, and 310 miles, "and perhaps as many more," according to Mr. Stanley; while the Shimeeyu is calculated at 229 miles.

One other remark regarding the Kagera. Mr. Stanley tells us that during the dry season it exceeds in volume the "Thames and Severn united, and is 70, 80, and 120 feet in depth, with a width of 150 to 200 yards; and, as it passes through the shallow Lake Ingezi, which is 5, 10, and 14 miles in width, it sustained its depth of 40 to 60 feet." But whether this river, or the Shimeeyu, or any other river flowing into the Lake, is to be considered a source or not—among so many, and all so distant from the Nile—the honour will still remain with the parent-mother Victoria.

My own opinion on this subject is much in accord with that of a well-informed writer in the 'New York Sun' of the 15th of March last, and I cannot, perhaps, do better than quote his words:—"That he has verified Captain Speke's delineation of the Victoria Nyanza, only proves the excellent geographical results achieved by that officer; and Mr. Stanley deserves every credit for the minute survey he has made of the Lake, which confirmed the accuracy of Captain Speke's hypothesis. It is a pity he should not have been content to rest upon these laurels. Instead of this, he has assumed that if he can find out which of the numerous tributaries flowing into the Victoria Nyanza is the largest and longest, he will be entitled to claim that as the Nile. First, he found the Shimeeyu, and called that the source of the Nile. Unfortunately he afterwards came upon a much larger affluent, called the Kagera, which entirely extinguished the Shimeeyu, and then he called that the Alexandra Nile. But this river had been examined by Speke and Grant; and it is a gross violation of all etiquette among explorers for a new name to be given to it by a gentleman who visits it

fifteen years after its first discovery, and calls it the Alexandra Nile, in order that, should he ever discover its source, he may claim to have discovered the source of the Nile. In the first place, it is not the Nile, any more than a stream running into Lake Superior can be called the St. Lawrence; and in the second place, if it was the Nile, he has not discovered it. This he frankly admits. Had he read Captain Speke's book he would have found that that officer fully appreciates the importance of the Kagera River as probably the largest affluent of the Victoria Nyanza; but he judged, and judged rightly, that where a huge lake is fed by hundreds of affluents, several of which are nearly of a size, the river that runs out of it is not the same river as any one of those affluents. . . . The true Nile only begins where it issues from the Lake."

"Mr. Stanley would also have found, had he had Captain Speke's book with him, that he advances nothing new with regard to the watershed on the west of the Victoria Nyanza. Speke lived for several weeks at Rumanyika's, almost on the banks of the Kagera, and within 50 miles of the Lake which Mr. Stanley never saw, but of which a map is given in the 'Herald,' as though he had discovered it, and which, not having discovered, he has no right to call the 'Alexandra Nyanza.' The proper name of this lake is Akenyara, and it is to be found carefully delineated in one of Speke's maps. 'What I could not see,' says Mr. Stanley, 'because of the mountains of Ugufu, was Akenyara, but my guides assisted me to understand tolerably well the position of the Lake.' Here-upon exclaims the 'Herald: 'The grand problem of the geographical era, which may be said to have commenced with the days of Ptolemy, has been the discovery of the sources of the Nile. To solve it many explorers have essayed and failed, leaving to Henry M. Stanley the palm of the victor, the glorious prize of success!'"

Although I should not have expressed myself exactly in these terms, I concur in the justice of the opinion here given of the want of originality in these so-called discoveries. It should, however, be said that since Speke and Grant gave no names of their own to either lake or river, but merely recorded the native names, the deviation from good taste and usage in any later explorer—who as regards the river had really navigated some 100 miles of its course—to give it a name of European origin is not wholly without precedent or justification, whatever may be said as to the lake which he only took on native report, and never saw. I may cite here the precedent afforded by Speke himself, who gave the name of Victoria

to Lake Ukerewe; and, still nearer the point, that of Sir Samuel Baker, who re-named the "Little Luta N'zige" of Speke, the Albert Nyanza.

Mr. Stanley, when his last letter was written, had been suffering after his long cruise, and the natives around him were dying of small-pox, at the rate of forty to seventy per day. But he was to leave on the 24th of August last, by crossing the Lake and making for Nyangwe. There he would decide as to his future route of exploration by proceeding to the M'Kinyaga country, where he expected to find the true head of the Kitangule Kagera, or he would follow the right bank of the Lualaba to "some known point."

Turning to the more northern portion of Nile Land, we find that Dr. P. Ascherson, who, two years previously, had been botanising with Rohlf's, had left Benisuef, Egypt, on the 16th of March, 1876, for Medinet-el-Fayum, and reached Bauite, the capital of the Oasis Parva, on the 1st of April, returning by a new route to the Nile at Samalut, having completed the flora of the region, and discovered plants in the oasis which were of a more Eastern habit, and not known to have existed there.

Drs. Schweinfurth and Gussfeldt returned last May from a visit to the desert countries to the east of the Nile, near the monasteries of San Antonio and St. Paul. The former had botanised and studied the geology of the region, and the latter had determined the positions of twenty stations.

*New Routes to Central Africa.*—On the Zanzibar side of Africa great strides are being made to open up the interior to commerce; but we want the country more fully surveyed before stating what particular routes are the best. On this subject I would call your attention to the excellent paper by Mr. E. Hutchinson (of the Church Missionary Society), published in the 'Journal of the Society of Arts,' March 30th, 1877. No doubt there is ample room in so extensive a region, from north to south and from east to west, for half-a-dozen routes. The line from Formosa Bay by the River Dana and Mount Kenia to Victoria Nyanza would recommend itself as the shortest to this great lake: but, till a survey has been made of it, we cannot say whether the country or the inhabitants are such as to render such a route practicable. Sooner or later, however, it must be one of the principal ones to the north end of Victoria Lake. Proceeding further south to Mom-

bas, a route from here westwards in the direction of the southern end of Lake Victoria would have the advantage of being the shortest to this named point. Then follow routes to M'papwa, as adopted by Mr. Mackay and the Rev. Roger Price; the old main road to Unyanyembe. Also the Rovuma route upon which, at one hundred miles from the coast, the Rev. Dr. Steere has placed a colony of liberated slaves as an experiment. In connection with this, a recent visit paid by Dr. Kirk, in H.M.S. *Philomel*, to the coast district between Kilwa and Cape Delgado, has an important bearing. In a despatch, a copy of which has been sent to us by Lord Derby, this experienced observer says that a great change had taken place since 1873, in the trade and social condition of this region. The slave-trade, which formerly constituted almost the sole occupation of chiefs and merchants, had ceased, and in its place a healthy and active commerce in the natural products of the country had become established. We learn also from Dr. Kirk, that Capt. Elton, Consul at Mozambique, is about to visit the northern end of Lake Nyassa, via the Zambesi and the Shire, and thence to return to the coast overland, thus supplying the desideratum—the exploration of the nearest route to the northern end of the lake, which is dwelt upon in Mr. James Stevenson's recent pamphlet, 'Notes on the Country between Kilwa and Tanganyika.' All these are advances towards civilization, and we hail with pleasure the worthy efforts that are being made to establish a regular route for communication between the port of Kilwa and the north end of Nyassa, as it will be an independent means of transport for goods to the shore of the Lake, and need not interfere with, but will encourage, the trade of the Portuguese at Quillimane and other possessions on the coast. It is also in contemplation to survey a road connecting a depôt at the north end of Nyassa with the south end of Tanganyika, where the London Missionary Society propose to form a station in connection with others at Ujiji, or some such suitable place. Further south still, an attempt will probably be made to survey a direct line of country, from south to north, from the Gold-fields of the Trans-Vaal to Unyanyembe. The Church Missionary Society are trying to construct a road to M'papwa, and we expect to hear shortly that their parties have been received by the Kings M'tesa of Uganda, and Rumanyika of Karagweh. One party has already reached Kagehyi, on the southern shores of Victoria Nyanza; on the other hand, a well-equipped party of the London Missionary Society left England

on the 14th of April last, *en route* for Lake Tanganyika, via M'papwa. The good service rendered by the Rev. Roger Price—in having successfully travelled to M'papwa with four bullocks for the purpose of ascertaining whether the route was suitable for the employment of these animals—is most commendable: he found by actual experiment that it is perfectly feasible to take a bullock-wagon from the Eastern Sea-coast up to the Central Plateau, and that there is neither jungle nor swamp, hill nor tsetse-fly, to hinder such a course. This marks a new era in African travel; for if the impediment of porters can be got over by any means, whether by bullock-carts, or, which we have more faith in, camels as beasts of burden, we shall be independent of porters, and be able to employ the men in other ways.

We were rejoiced on the 26th of February last to have Mr. E. D. Young once more amongst us, and to hear from him an account of his latest journey to Africa. He has successfully established the Missionary party, sent out with splendid liberality by the Scottish Free Church Mission Committee, at "Livingstonia," on the southern shores of Nyassa; and has been the first to launch a steamer on the waters of an African lake. After an absence of twenty-one months, he has returned, in nowise impaired in health or energy by the work he performed. The chief interest in his journey to us Geographers is that the Lake is found to be 100 miles longer than Dr. Livingstone supposed it to be. We may also congratulate ourselves on the fact that Mr. Young has made a treaty between the Makololo and the Maviti, or Watuta of Speke. The latter are a wandering and plundering set of thieves and murderers, who range along the Nyassa Lake, extend to Tanganyika, and have even crossed the route between Unyanyembe and Usui. They are a very numerous class, of no particular race; and if this alliance made by Mr. Young holds good, and were extended to them all, trade and the industry of the regular inhabitants would have a better chance of succeeding.

*German Expeditions.*—Dr. Lenz returned to Hamburg from the Ogowé and Gaboon region, West Africa, on the 27th of January last, his farthest point having been a waterfall beyond Lonju on the River Muni, where his stores failed him. The Doctor's health had suffered severely from dropsy.

Dr. Pogge reached Hamburg on the same date, having made a most successful journey to Musumbe, the capital of the present Muata Yanvo, the suzerain of the Cazembe. His farthest point

was Inshabaraka, and he would have gone to the town of the Cazembe but was prohibited. By travelling with a native caravan he obtained much information regarding the countries between the Kasai and Quango, and made considerable collections of insects and plants, besides getting sixteen skulls of numerous races of the interior. Musumbe, which had never before been visited by any explorer, lies many days' journey to the north, and west of Cameron's line of march. Dr. Pogge thinks that the River Kasai is the main feeder of the Congo, and that the Lualaba belongs to the Ogowé system, but this is disputed by other authorities.

Herr Edward Mohr, who came to England last year, and was present at our Anniversary Dinner, is said to have died of fever on the 26th of November, 1876, at Melanje. There was also a rumour of his having been poisoned, but we have no particulars as to his exact death. He had reached St. Paul de Loando on the 28th of August last, and left for Melanje upon the 1st of September. Turning to the East Coast of Africa, we learn that Dr. G. A. Fischer and Herr A. Denhardt (an engineer) were to proceed to Zanzibar last December, in the hope of ascending either the River Dana or Ozy, near Formosa Bay, and penetrating *viâ* Kenia to the Victoria Lake. This is one of the most important routes, as previously stated, in East Africa; and, if the people in the interior prove hospitable, great results may be expected from opening up this, perhaps the most fertile region in Africa, being within a degree or so of the Equator. They are to introduce a novel mode of communication—carrier-pigeons. Herr J. M. Hildebrandt also proceeds in this journey to the Lake.

Dr. Ervin von Bary reports in December last, to the German African Society, that he was on his way to Jebel Ahaggar, in the Tuareg country; but in consequence of disturbances there, he has altered his plan, and purposes reaching Timbuctoo by a more southerly route. The latest account of the Doctor is that he had reached the hot-spring of Sebarbaret, which is 150 miles north-west of Ghat.

*French Expeditions.*—The Expedition under Lieutenant de Brazza, of the French Navy, with Dr. Ballay and M. Marche, and seventy soldiers, intended to proceed from the west up the River Ogowé, and on till they reached the Albert Nyanza or the Niam-Niam country. Dr. Ballay arrived at a point 250 miles from Gaboon; but the party had suffered much in the loss of instruments by the upsetting of canoes. There was a greater annoyance still than this:



the tribe of Osyeba were not at all inclined to be friendly, having had a serious misunderstanding with a previous party of explorers : and it was doubtful whether the present party could proceed to the interior by this route. M. V. Largeau, who had made two journeys in the north-west of Africa, was appointed by the French Geographical Society to command an expedition from the Mediterranean to Assini on the Gold Coast last July. He would explore the Jebel Ahaggar in the Tuareg country, and visit Timbuctoo. The latest accounts were received in April, stating that M. Largeau would leave Biskra for Tuat, *via* the Wady Myah, on his way to the Ahaggar country, immediately on receiving his supplies. Surveys of the coasts of Southern Tunis and Tripoli, which are occupied by tribes who are said to plunder both by sea and land, have been completed by Captain Mouchez, of the French Navy ; and Captain Rondaire has completed the levelling of the Tunisian Shotts, leaving no doubt that an inland lake might be formed to the south-west of Algeria.

*Italian Expedition.*—The Marquis Antinori and party having left Europe on the 8th of April, 1875, on an exploration of four years to the capital of Shoa, and thence to the Equatorial Lakes, had reached Lichi, in the kingdom of Shoa, all safe and well, after, however, having escaped assassination between Zeila and Harar, and experienced difficulties in crossing the Hawash. He anxiously looked for the arrival of Captain Martini with supplies before proceeding farther ; and as this officer was to be conveyed to Zeila in the Italian corvette *Scilla* last March, we hope the Marquis will not be detained in proceeding upon his very important journey to Victoria Lake, but, meantime, he had met with a gun-shot accident.

*Portuguese Expedition.*—We have lately heard that the Government of Portugal have, with the most enlightened liberality, reminding us of their former glory in Geography, voted the sum of 20,000*l.* towards exploration in the interior from their possessions on both coasts ; and we congratulate their Geographical Committee, and welcome them in the field of research and discovery. They have suffered a great loss in the death, on the 7th of December last, at Loanda, of Baron Barth, who was engaged on a Geological and Geographical Survey of Angola.

*West Coast.*—M. M. J. Bonnat, a resident for many years in Western Africa, particularly in the Ashanti country, took five boats and twenty-seven men up the Volta River on the 7th of December 1875, and reached, partly by water and by land, Salaha, or Paraha.

the commercial capital of these parts; a town which was very populous at one time, but now contains only 18,000 people. M. Bonnat states that the Labelle Rapids, though 25 feet high, can be ascended by steamer during the rains in September and October, because the river rises 50 feet at this season.

We have already alluded to the interesting Paper of Captain J. S. Hay, who read it to us last June, on his residence for three months at Kyebi, the capital of Akém, West Coast of Africa. The district lies between 6° and 7° N. lat., and to the east of Ashanti. The Captain was there on duty guarding the Protectorate, during a war between the Ashantis and Djaubins, towards the end of 1875. In November, when he traversed the route from Accra inland, it was mud and water for days, and rain fell daily. On reaching the interior, the country is mountainous. The people live on the tops of their hills in houses completely concealed by the dense primæval forest; but there is abundant food obtainable, the soil being rich, and four rivers run through the country. These are only navigable for small boats, and are broken by waterfalls. Gold and timber seem to be the richest products of this region.

AFRICAN EXPLORATION FUND.—Having now passed in review the various African Explorations, British and Foreign, already completed or in progress during the past year, it only remains for me to bring more especially under the notice of this Meeting and the Society, the steps which have been taken since my opening Address to give effect to the desire of the Council to promote, to the extent of their power, the continuous and systematic exploration of Africa, and more especially of that large region extending from the Equator to the Cape of Good Hope. After the Meeting of the Conference at Brussels in September 1876, at the invitation of the King of the Belgians, and from that time, the subject has engaged the serious attention of the Council. Unable by the Charter of the Society, and the declared objects of its constitution, to enter upon any undertaking not strictly Geographical, it was found impossible for them to take part in the International Organisation inaugurated at the Brussels Conference for much larger objects. They were reluctantly, therefore, obliged to decline entering into the plans for affiliated and international labour in this field, and to form a separate Committee, under the title of an "African Exploration Fund Committee," acting under the direction of the Council, and independent of all International or other

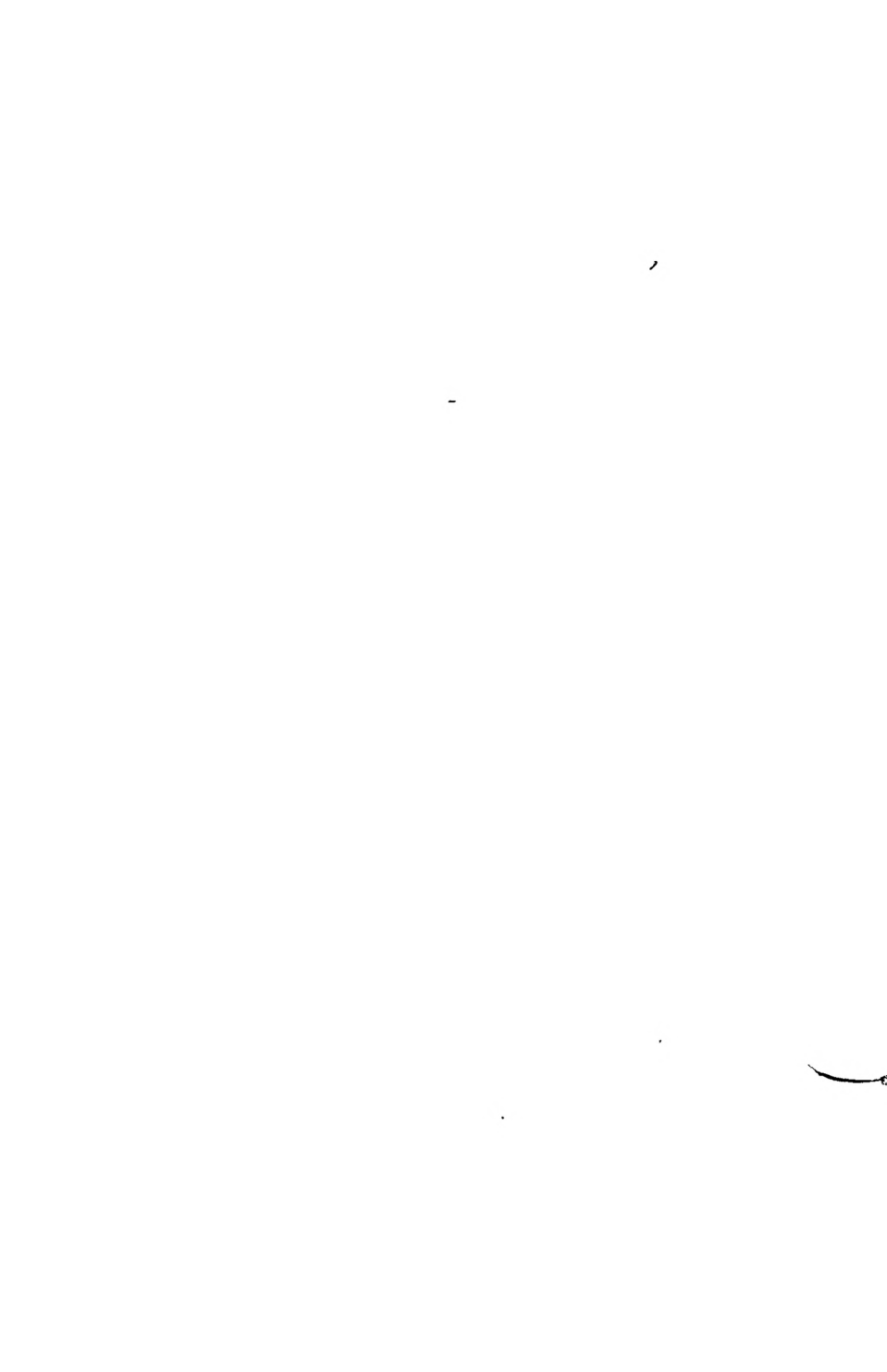
Associations and Societies with similar objects. Independent so far as their responsibility and action are concerned, they will maintain a correspondence, and cordially co-operate as far as the constitution of the Royal Geographical Society will admit, with all other Societies or bodies engaged in advancing African Exploration, and more especially with the International Commission permanently sitting in Brussels.

The Council, animated with these sentiments, placed them, together with the objects they proposed to accomplish, on record in a Minute constituting the Committee above referred to, and defining their powers and the duties assigned to them. Having obtained the consent of His Royal Highness the Prince of Wales to associate his name as Patron, this Committee have since been maturing their plan of operations, and preparing a Sketch-map to accompany a Circular, appealing to the Society and to the public for support and co-operation in the prosecution of such continuous and systematic Explorations in Africa as they are satisfied will best advance the Geographical knowledge of these regions, and, in the proportion that it is attained, will also materially tend to promote both commerce and civilisation.

This Circular, and the proposed proceedings of the Committee, have now received the sanction of the Council, and it will be very shortly circulated among the Fellows, together with the original Minute; and, in that shape, it is thought the whole subject may be brought before the public in a satisfactory manner, with a view to obtain the necessary funds. Great interests, besides those of Geographical science, are concerned, if not inseparably connected with a successful prosecution of the work now contemplated, and the subject is one of the most important, both in a national and philanthropic sense, that can well engage the sympathies and attention of this Society and the community at large. Under these circumstances the Council feel confident that the appeal they have now willingly sanctioned will meet with a ready response over a wide area, not limited to the United Kingdom, but including all our Colonies, one of which, by no means the least important, is more deeply interested in the prosecution of these Geographical Explorations than any other portion of the British Empire.

## POSTSCRIPT.

*Chinese Empire.*—After the foregoing was made ready for the press, I received from our Honorary Corresponding Member, Baron von Richthofen, the well-known geologist and traveller in China, a copy of the first volume of his magnificent work, entitled ‘China, Ergebnisse eigener Reisen und darauf gegründeter Studien. Berlin, 1877.’ The Presidential Address for this year would be very incomplete without a brief notice of this volume, forming, as it does, the commencement of what will undoubtedly be one of the most complete works on a subject of Special Geography which has appeared in our time. The volume, although only the introductory part of the work, forms a handsome quarto of 760 pages, well illustrated by maps and diagrams, and treats principally of the General Geography of Central Asia and China Proper, entering thoroughly into the formation of the surface and the causes of the striking diversity between the central and outer regions, the nature of the “loess” which covers nearly all Northern China, and is the cause of its fertility, and other features of Physical Geography. The more detailed account of the author’s investigations of the coal-fields and general Geology is reserved for the subsequent volumes, three in number. The completed work will be accompanied by an Atlas of 44 maps, constructed by the author, who made this one of his chief tasks during his long journey through the Chinese Provinces.



PROCEEDINGS  
OF  
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED SEPTEMBER 19TH, 1877.]

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SESSION 1876-7.

*Thirteenth Meeting, 11th June, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*Edward W. Balt, Esq.* ; *Henry Davis Hoskold, Esq. C.E.* ; *Victor Milward, Esq., J. P.* ; *Frederick Ernest Remfry, Esq.*

DONATIONS TO THE LIBRARY, MAY 14TH to JUNE 11TH, 1877.—  
Report upon Geographical and Geological Explorations West of the 100th Meridian, in charge of Lieut. G. M. Wheeler, Vol. V., Zoology, Washington, 1875 (*Lieut. Wheeler*). General Reports of the Revenue Survey operations, India, for 1871-72, 1872-73, 1873-74, and 1874-75 ; General Reports on the Topographical Surveys of India, for 1873-74, 1874-75, and 1875-6 ; and Taylor's General Report of the Marine Survey of India, 1874-76 (*H. M. Sec. of State for India*). Eine Spazierfahrt im Golfe von Corinth, Prag, 1876 (*Anonymous*). New Zealand, graphic and descriptive, by C. D. Barraud and W. T. L. Travers (*C. D. Barraud, Esq.*). Pajinas de un Viaje al traves de la America del Sur, por Carlos Walker Martinez, Santiago, 1876 (*Author*). Légende territoriale de la France, par — Peiffer, 1877 (*Author*). Materials for a Climatology of the Caucasus, Pt. 1, Meteorological Observations, vol. i., in Russian and German, and Das Reflexions Thermometer, by A. Moritz, and Ueber die geographische Lage von der Stadt Teheran, von J. Stebnitzky (*Dr. A. Moritz*). Journal of a tour of exploration in the north of Madagascar, 1876, by Bishop Kestell-Cornish (*H. D. Tucker, Esq.*). Supplement to Report of permanent Committee of the first International Congress at Vienna ; meeting at London, 1876 (*The Meteorological Committee*). Studi

sulla razza Negrita, and *Il Brasile* nel 1876, by E. H. Giglioli (*Author*). *Baku* as a Central point of the Overland Route to India, by W. Fabritius, translated by Capt. F. C. H. Clarke (*H.M. Sec. of State for War*). *The Winds and their Story of the World*, by W. L. Jordan (*Author*). *The Puzzle of Life*, by A. Nicols (*Author*). *Det Danske Geografiske Selskabs Tidsskrift*, i., Hefte 1 and 2 (*The Danish Geographical Society*). *Ueber den Inhalt der allgemeinen Bildung in der Zeit der Scholastik*, von R. von Liliencron, and Nanak, der Stifter der Sikh-Religion, von Ernst Trumpp (*The R. Bavarian Academy of Sciences*). *Palæontologia Indica*, ser. x. 2, and ser. xi. 1, and 8vo. *Memoirs of the Geological Survey of India*, vol. xii., pts. 1 and 2 (*The Governor-General of India, per Superintendent of the Survey*). *Astronomical and Meteorological Observations for 1874 at the U.S. Naval Observatory* (*The Observatory*). *Report on the trade at the Treaty-ports of China for 1875*, by H. Kopsch (*Author*). *The Journal of Eastern Asia*, vol. i., No. 1, edited by James Collins (*Editor*). *Why is 43 a basal biblical number? and Key to the genealogical table of the first patriarchs in Genesis, &c.*, by Victor Rydberg, translated by S. M. Drach (*S. M. Drach, Esq.*). *Bericht über die geologische Durchforschung der Provinz Preussen im Jahre 1876*, and *Das Relief der Provinz Preussen*, Begleitworte zur Höhenschichtenkarte, von A. Jentzsch (*Author*). *A refutation of the Report of the Scurvy Committee*, by C. R. Markham (*Author*). And the current issue of publications of Corresponding Societies, Periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM 14TH MAY TO 11TH JUNE, 1877.  
 —Geographical Explorations and Surveys West of the 100th Meridian; I. Topographical Atlas containing 16 sheets; II. Geological Atlas containing 6 sheets (*Lieutenant G. M. Wheeler, U.S. Engineers*). 3 maps from the 'Geographische Mittheilungen,' and 2 maps to illustrate the Seat of War (*Dr. A. Petermann*). Williams' map of United States, Canada, Mexico, Central America, &c. (*A. Werbrouck*). Stanford's library map of Africa, mounted on spring roller, and Orographical map of Africa; Arrowsmith's Turkey in Europe and Turkey in Asia; Stanford's Turkey in Europe and Asia, &c.; Sheet I., Stanford's large scale map of the Seat of War in Europe, and map of the Acquisitions of Russia since the accession of Peter I. (*Edwd. Stanford, Esq.*). *The Mediterranean Sea*, with enlarged maps of Egypt, the Suez Canal, &c. (*Messrs. W. & A. K. Johnston*).

THE PRESIDENT informed the Meeting that the Paper to be read was by Bishop Crowther, who had been good enough, at his request, to prepare some account of his experiences in journeying to and fro on the Niger and in the adjacent countries. Some 30 years of the Bishop's life had been devoted to missionary

labours in that region, and he had amassed a large amount of knowledge regarding the tribes, languages, and geographical characteristics of the country.

The following Paper was then read by Mr. EDWARD HUTCHINSON :

1. *Notes on the River Niger.* By the Right Rev. Bishop CROWTHER.

It is now thirty-six years ago since I first visited the River Niger, having in the year 1841 been appointed to join the expedition sent out by the British Government, under the late Captain Trotter. Since that time I have accompanied I think almost every expedition of the Admiralty, and when they ceased, I have gone in the various trading steamers which now, to the number of five or six, make the annual ascent of the river. During this time I have had, as may be supposed, many varied opportunities of becoming acquainted with the geographical features, not only of the River Niger itself, but also of the countries which lie adjacent to it on either bank. I have twice marched from the Niger at Rabbah and Bida, to the sea-coast at Lagos, and I have endeavoured to gather such information as I could, as to the peoples, their habits, languages, and races; and also as to the chief directions of the trade from and to the interior of the countries which lie to the east of the Quarra, and to the north and south of the Tshadda Branches. The traveller, Dr. Barth, has given so full an account of those to the north of the Tshadda or Binue, that there is no occasion for me to say anything of these, and I am rejoiced to learn that the German traveller, Dr. Nachtigal, has explored the countries which lie between the limits of Dr. Barth's discoveries and the territory of Darfur. I shall, therefore, confine my remarks to what I know of the river and its branches, and also of the adjacent countries.

Two very marked divisions at once present themselves in endeavouring to give a description of the Niger and its adjacent countries, and these are the Upper and Lower Niger, or, to speak more correctly, the Delta of the river, and its course through the main land. What the actual extent of the Delta of the Niger is remains at present unknown. Whether the Old Calabar River with its affluents form any portion of the Delta is uncertain. It is not improbable that there is a communication between the Tshadda and Cross River, explored by the late Mr. Becroft; at any rate, it is remarkable that the Akpah tribes of Adamawa seem to have found their way down to Fernando Po by some short cut. But to the west there is no doubt that the vast system of marsh and lagoon, which reaches as far as Porto Novo, to the west of Lagos, is more



or less connected with the Delta of the river, though it also owes its existence to the smaller streams, which pour their mud-charged waters down from the higher levels of the Yoruba country. Thus, what may be called the Delta of the Niger is a vast tract of marshy country extending along a coast line of some 120 miles, with a depth to the interior of about 150 miles at the broadest part.

The recent explorations, begun by Sir John Glover and Captain Goldsworthy, and followed up more recently by the Rev. Messrs. Maser and Roper of the Church Missionary Society, have made us acquainted with the characteristics of the western portion of the Niger Delta, and have showed us that as regards the features of the land there prevails a monotonous uniformity of intricate canal and marsh, villages hidden in the dense growth of reeds, the people partaking of all the characteristics of the dwellers in African swamps; and all, as far as it was possible to ascertain, speaking, even up to Benin, with slight modification, the Yoruba language, the same as it is spoken at Badagry, Abeokuta, Ilorin, and Ibadan.

The character of the central portions of the Delta, as it presents itself to the eye on approaching, is so well described by Captain Allen, that I venture to quote his words here :—

“The Rio Nun, the chief entrance, from its size, has the appearance of an estuary, being more than a mile and a half wide and five miles in length; the other outlets resemble this.

“The opposite sides of the river appear to be of different formation. Cape Nun, the termination of the right bank, has a long spit of sand running into the sea about one mile and a half. The shore of the right bank is generally swampy, formed by a deposit of mud brought down by the river, the outside of which presents a sandy appearance; it is intersected by innumerable channels of water, of a brackish and putrid taste. Where dry spots are found, they are cultivated by the natives from the other side. The bed of the river is covered with a blue clay. Whenever the clay was broken by the rapidity of the current, the pieces were immediately carried off by the moving water; and it often happened that the spring tides washed them ashore, in the shape of cylinders. These, being left behind by the retreating ocean, formed one of the peculiar characters of the right bank of the river.

“In the swampy parts of the right bank, the mangrove abounds with its peculiar fructification. The numerous arching roots of this tree are favourable for the deposition of sand and mud.

“In the woods on this bank, the water was upwards of two feet deep in most parts, and the air close and confined.

"Passing through a narrow channel, the river expands to a wide sheet of water, with many islets, and several broad and promising channels on the right and left. Nothing at this part was to be seen indicative of anything like *terra firma*; the visible boundaries of the river in all these branches being an endless confusion of the arching roots of the mangrove, the only occupant of this swamp. At low water their roots are covered by slimy and stinking mud, with decayed vegetable matter; to which may, not unreasonably, be attributed the deadly character of the locality.

"The banks began gradually to assume the appearance of firmer land, at first without any vestige of the operations of man; but soon some small cultivated patches were seen, bearing plantains, a few fishing stakes and a small fishing hut, &c. The large and umbrageous trees, with their festoons of *Orchideæ* and purple and white *Convolvuli* hanging from the branches, formed a combination of forest scenery so striking, novel, and interesting, as enabled us to forget that the much-talked-of Delta of the Niger had been fairly entered upon. The reeds gave place more frequently to patches of cultivation, in the midst of which were small granaries, raised from the ground on poles, to secure the stored productions of the soil from the overflowing of the river, as well as other more cunning depredators, as the proprietor lives in a distant village. Sunday Island—20 miles from the sea—is the highest point to which the sea-tide reaches in the dry season, clearly indicated by the gradual but rapid disappearance of the mangrove-trees.

"Ferns, the *Ficus*, *Mimoseæ*, and various shrubs and bushes of small growth, increase above Sunday Island; and the banks, which previously were swampy, become somewhat firm; and the eye—wearied by the melancholy and monotonous hue of the mangrove—is delighted to witness the rapidly increasing vegetation, which soon assumes all the dignity of the tropical forest.

"At about 65 and 75 miles from the mouth of the main stream there are two important branch outlets; the first flowing to the west, called the Wari branch, finding its way into the western portion of the Delta; and it is believed that the Niger might be reached by means of this branch from the lagoons at Lagos. The second outlet leaves the Niger at Ndoni, and from what I have heard at Bonny, I have good reason to believe it communicates with the outlets called the Bonny and New Calabar Rivers. Both these important outlets are closed by the jealousy of the tribes on the river."

The Wari branch was called the Benin by Lander, because by it the town of Benin may be reached. This branch has been

explored recently by the steamers of the West African Company which reached the river.

It is also supposed that from the Ndoni branch there is a connection with the River Jumma, or the old Calabar or Cross River, explored by Becroft in 1841.

Up to these points the Niger flows between low clay-banks; the whole country around is flat and swampy. Here, however, at some little distance from the stream, gently-rising hills are seen on either side, indicating that we have passed the Delta proper, and are now entering on the main stream of the river. The character of the river here changes; instead of the numerous and rapid windings of the lower reaches its course is nearly straight, and the breadth is about a mile and a half. At this point, also, a change in the character of the people takes place. On the eastern side of the main stream they are of the Ibo or Idzo tribes, entirely pagan, with various forms of idol and fetish worship, two marked features being the idea of sacrifice, ordinary victims being domestic animals, and on special occasions single human beings, but with no such indiscriminate slaughter as at Dahomey or in Ashanti. The town of Adda-Mugu is the point where a new territory—that of Igara—begins. This was the town of that Abokko who was so friendly to the traveller Lander; and his sons, or kinsmen, are chiefs of the country on the east bank up as far as the confluence. One of these sons, with whom I had been on friendly terms for some time, took advantage of an attempt I made to ascend the river in a small boat, to make me a prisoner in 1868. I was rescued by Vice-Consul Fell, but in the scuffle he was struck by a poisoned arrow, and died.

At Adda-Mugu, also, the character of the dwellings changes. Here, for the first time, are seen the circular conical-roofed huts, which prevail in the interior; the dwellings up to this point are the usual square or oblong low huts.

About 40 miles above Adda-Mugu is the town of Iddah. This town I first visited in 1841, and have subsequently visited it on several occasions. The river here flows through a low chain of hills formed of red sandstone, and the cliffs of this material on either side of the river are an entirely new feature in the river scenery. They rise to the height of 185 feet; on the summit are the conical huts of part of the town of Iddah. From the summit a splendid view is obtained. To the north and south the river is seen extending for many miles, while on the western bank there is seen an undulating country, bounded on the far west by the mountains of the Yoruba country. The town of Iddah, the largest and

most important in the kingdom of Igara, is built on the summit of the cliff on the east bank of the river. There are about 2000 huts, and about 8000 inhabitants. Nearly all the dwellings are the usual circular huts; the walls rise about 6 feet, and are built of clay and stone; the roof is conical, and thatched with palm-leaves.

After leaving Iddah, the river continues to flow between sandstone cliffs and sloping banks, behind which are table-lands and gently-rising hills. In about 40 miles another region seems to be reached. Large rocks of quartz are seen, and the mountains on the eastern side are steep and conical. Down their sides are deep ravines, which, in the rainy season, are mountain-torrents. Continuing to the north, the mountains close in upon the river, until at last the confluence is reached, the junction of the two rivers, Quorra and Binue.

When I made the ascent of the river, in 1854, with Dr. Baikie, we together ascended the hill, called Mount Patted, opposite the confluence. I cannot do better than use Dr. Baikie's words to describe the scene we saw. "From an elevation of 400 feet we saw immediately beneath us the pretty green-topped Mount Stirling; on our left was a deep ravine separating us from another flat-crowned hill; on our right lay the land purchased in 1841 for the model farm, bounded to the southward by steep and rugged mountains.

"Flowing from our left, and meandering round the base of the chain of hills on which we stood, came the narrow Quorra, while full before us came journeying from the eastward the broad straight-coursed Binue, the mingling waters of the two mighty streams forming the lake-like confluence, its surface dotted with islets and banks, or rippled by contending currents, while in the distance on the right the united rivers rushed impetuously to the sea through the deep defile by which we had ascended.

"Along the banks numerous villages could be discerned. Far as the eye could reach, for miles and miles, the ground teemed with the exuberant vegetation. Such a fruitful soil in other climes, and with a happier population, would yield support and employment to thousands, and long ere this have proved the source of untold wealth. The peninsula formed by the junction of the two rivers is a miniature Delta, low, swampy, and intersected by numerous streamlets. The natives fancy there is a difference in the colour of the two streams, and call the Quorra the white water, while the Binue is known as the black water."

The furthest point to which I have been upon the Quorra branch is the town of Rabbah. Along the western shores of the river

there extend ranges of hills, which are, in reality, the fringe of the high table-land which stretches towards the Yoruba country, while similar hills are on the northern and eastern banks of the Quorra branch.

One remarkable characteristic of the Niger River is the varying character of its channel, caused, no doubt, by the remarkable rise and fall of its waters from the tropical rains. One result of this is that it is almost impossible to navigate the river except at flood time, unless in vessels specially adapted with a very light draught of water. There are parts where sand-banks so obstruct the channel, that not more than four or five feet of water is found during the dry season, and on this account it is most important that attention should be directed to the establishment of a route by land from Lagos to the confluence. This is an existing and long-established route, and I have myself twice traversed it. The last time was in the year 1871, when it was found impossible to return in the steamer, the river having fallen so rapidly as to render the attempt hopeless.

I had therefore to arrange for a return from Lokoja, at the confluence, to Lagos by land. About 8 A.M., on the 6th of November, we started for the journey, some on horseback, others on foot.

After going up and down two or three abrupt small hills and valleys, we came to the foot of the great mountain, Pati Aba, where there was a spring of water; here all rested and took refreshments, preparatory to the great ascent; this done, we betook ourselves to climb. About an hour's climbing, all got to the top of the mountain, where there was water in hollows of rocks. Though to us the ascent seemed formidable, yet the carriers, both male and female, with loads of from 56 to 60 lbs. on their heads, ascended it patiently with their burden; it was a hard labour for them, though they had been accustomed to travel on it; there was no other way to get to these hilly countries.

All our party having got to the top of the mountain, we rested awhile; then we travelled on the level rocky plateau for the rest of the day, till we arrived at the town of Agbaja, fortified with walls, and situated at the edge of a deep valley, in shape like an oval dish-cover, and well cultivated; native plants of every description were growing in it; besides which, it was adorned with a forest of stately palm-trees, and other trees of full, green foliage, resembling a gentleman's plantation in this country. A spring of water issued out of the mountain. Other similar valleys were passed. The plateau is sandstone, covered with shallow earth, from about 6 inches to 2 feet deep for miles. In many parts the rock is quite bare.

As we were perfect strangers in this part of the country, we had to follow the carriers, who, according to custom, carried our loads free of expense, because we were the King's strangers, till we came to the next town, called Ikushemi, about mid-day, where the carriers left the loads to their neighbours to carry in their turn, and returned to Agbaja. We travelled on the plateau in a parallel line with the river for about 8 miles, when we descended the mountain on the north-east side, and travelled on the lowland plain of Ikushemi. Our way now lay north-east towards the river, in very bad, swampy grass-fields. In some places we had to dismount, and cross the swamps and streams on foot to the middle, because not safe riding.

We crossed the river at Gori in canoes, and reached Bida on the 27th of November. We had interviews with King Masaba about our journey to Lagos. As we could not push our departure faster than the King could arrange, we thought it better to leave the whole arrangements with him; this being the Ramadan fast month, one could not push business very rapidly at this season.

The festival being over, the King also having received all the information he wanted, called and presented each of us with a horse for the journey—twelve in number—assigning this as his reason for doing so, because Saraona (the Queen) had been showing him special kindness since the last nine years, and he had not been able to make any suitable returns; this was an opportunity for showing his appreciation of the Queen's kindness to him.

From Bida we travelled along the eastern bank of the river, passing through a hilly country, until we reached the ferry at Shonga. This is the present starting-point from the Kowara for Ilorin and the Yoruba country.

From Shonga we marched to Saregi. At the gate of Saregi we came to the point of the road from Rabba, the way by which I came from Rabba in 1859. Shonga is about 20 miles below Rabba; travellers starting from either of the lower points of the two angles, Rabba or Shonga, will meet at the upper sharp point of the triangle at the gate of Saregi town, which is the highway from the Niger to the Yoruba country.

From Saregi we marched to Ilorin, which is a large and important town of about 120,000 inhabitants.

The population are a mixture of Fulahs, Yorubas, Haussas, and Nupes.

The route from this to the coast lies through the towns of Ogbomosho, Oyo, Ibadan, and Abeokuta to Lagos. In the neighbourhood of Ilorin, Ogbomosho, and Oyo, the country is very undu-

lating, covered in some parts with thick grass; in others, with close, dense forests of a low-spreading tree, with a bark like that of the cork-tree. A remarkable feature of the country is the frequent appearance of high abrupt masses of granite rock, sometimes with precipitous sides.

They seem to shoot up from the plain as if forced through from below, and yet without disturbing the level of the surrounding country. All the streams that are met with to the south of Ogbo-mosho flow southwards, as if to join the Ogun, which flows by Abeokuta, or the Oshun, which passes Ibadan. As Abeokuta is neared, the country becomes flatter. The rocks at Abeokuta are also granite, and the prevailing character of the soil is a rich loam, with gravel in some parts. From Abeokuta to Lagos the land is almost level; at one place there are some slight hills.

I now propose to return to the Binue or Tshadda branch, which I explored in company with Dr. Baikie, in 1854. We found the river, after leaving the confluence, of considerable breadth, but the channel very tortuous. Here, as also lower down the river, a fresh strong breeze, which always, except during squalls, blows up the river. The scenery daily increased in beauty as we advanced up the stream, until at a point about 70 miles above the confluence, the river presents a noble appearance, far exceeding in breadth any part we had yet seen. The banks are clothed with tall palms and other graceful trees, numerous green islands diversifying the scene, and green hills stand out against the dark mountains in the background. Our vessel drew 7 feet of water, and the numerous shoals and sand-banks rendered navigation very difficult.

The district along the north side of the Binue, as far as we had come, was known by the name of Igbira, its extent being from the confluence, eastward, about 50 miles. The chief town was Pánda, and the country is often styled Igbira-Pánda. The people are highly civilised, friendly, civil, and most industrious; and a great deal of trade is carried on by their means. A few Mohammedans are to be found among them; but the great majority are pagans, but with fewer barbarous rites than any other heathen tribe we encountered. Tattooing is not practised, nor have they any distinctive mark. In person they are rather tall and well made, with a sub-typical negro countenance, and they generally keep the body well covered with clothes. They use a peculiar language, differing from the Igára, and having mixed affinities, chiefly with Nùpe and Yóruba.

The country on both banks of the river is covered with forest. Numerous towns and villages are placed along the banks, some-

times visible and sometimes hidden. Some of the scenery was occasionally varied by the appearance of ranges of hills, while in the various reaches of the noble river numerous wooded islands were passed as we ascended.

Above Ojogo the current ran nearly three knots, the river being for a short distance confined between banks, behind which was finely wooded rising land, where also oil-palms were noted for the last time. Along the river-edge, generally partially imbedded in the banks, were large, unshapely-looking blocks of rock, bearing evident marks of igneous action. A little farther on, a fine range of hills ran nearly parallel with the river on the north side, one extremity touching the water. Just beyond the current runs very strongly, averaging four knots, and the river takes a northerly bend. The banks on the south side are very high.

Many hills near this place have a very peculiar aspect, some being quite isolated and rising with steep sides almost suddenly from flat land near the river. Fresh breezes were blowing daily up the stream. Everything around us wore a smiling aspect. The river, still upwards of a mile in breadth, preserved its noble appearance, the neighbouring soil teemed with a diversified vegetation, and the frequent recurrence of hill and dale pleased and gratified the eye. Nor was animal life wanting, for from our mast-head we enjoyed the novel sight of a large herd of elephants, upwards of 100 in number, crossing a little streamlet, not much more than a mile from us.

Near this place we came upon a settlement of Fulahs, on the south bank. The district is named Zhibú, and there are three towns—Gándiko, Gankéra, and Zhibú. This settlement originated in a Fulah expedition sent to attack Wukari, a large town on the south bank, but it failed; so instead of returning to the northern shore, they founded these towns, and intermarried with the inhabitants of the district, the Djukus. The languages spoken are principally Púlo and Djúku, but Háussa is also understood by many. About one-half of the people are nominal Mohammedans, the remainder being pagans.

Most of the inhabitants were clad in native-made clothes, but some appeared in garments made of goat-skins, while a few wore still more scanty coverings of green leaves.

Pursuing our course up the river, we come to Zhibú. The town is about a mile from the river, situated on a rising ground, commanding a fine view of the Binue and the country around, and appears to be of greater extent than Idda in Igara, compact, and thickly populated. The chief said it would take us eight months



to go as far as Hamaruwa, and the river would rise during this month only, and begin to fall the next, and in a little time it would not be deeper than a man's waist; so that our ship, being large, would not have water enough for the voyage downwards. When the chief was asked if a bullock could be purchased, he said they had plenty, but they were with their masters. He was asked who these masters were, but gave an evasive answer; but we had learnt from the people that they were slaves of the Filanis, or Foulahs, who came from Yola and Hamaruwa.

About 40 miles from Zhibú the Binue, after passing through flat and then undulating country, receives its first affluent, which comes from the north. It then becomes extremely narrow, being hemmed in by rising ground, especially on the right side, for about a quarter of a mile. The depth was not less than 5 fathoms, and the whole volume of the Binue having to pass this narrow gorge, the current becomes so rapid, that it was difficult to stem it. After rounding Lynslager Point, we found the river spread its noble stream over as extensive a bed as before.

For some distance the river keeps its breadth, but there is plenty of water, from 3 to 4 fathoms. A new range of hills showed itself at a great distance on the left side of the river, consisting of many lofty conical mountains. It lay behind a long ridge of high lands, running to a considerable distance, almost parallel with the river, which presented a very picturesque appearance. The tops of some of these mountains are covered with luxuriant woods and jungles, and others are quite bare and rocky.

About 30 miles further up the river, we came to the town of Zhiru, on the southern bank, and landed; we found this to be another Fulah settlement, as in Gandiko, the conquering race reducing to slavery the aboriginal inhabitants. These are the Akpah, or Baibai Djukus, who are also met at Fernando Po. The old people retain their primitive costume of a few leaves; the younger having learnt from their conquerors to adopt a more becoming style of clothing.

Pursuing our journey, we anchored off the village of Tshomo, from which the capital town of Hamaruwa is about 14 miles distant. Hamaruwa is beautifully situated on a hill, rising on the south side of the range of the Muri Mountains, on the west side of the Binue. It commands a fine and extensive view. The river is seen stretching along like a narrow strip of white cloth, between the shades of light-green grass, which fringes the water's edge, and a little further back is the darker green of trees, and then the blue ranges of Fumbina, with the lofty Mauranu Mountain in Adamawa, on the left,

and the Muri Mountains in Hamaruwa, with their many fanciful peaks, on the right side, each at a distance of 12 miles from the river. In the valleys below the town, from 100 to 200 beautiful cattle were feeding, and this gave life to the scenery. The houses are round, with conical roofs, built mostly of mud, about 20 or 24 feet in diameter.

Although this period, the latter part of September, was not, as we afterwards found, that of the highest rise of the river, a temporary fall alarmed us, and preparations for a return were made; but in the meantime the leaders of the party had gone up the river in a boat, and had reached a point called Dulti, about 30 miles above Tshomo, and about 420 miles from the confluence.

One object of our expedition had been to inquire for the traveller, Dr. Barth; and though we heard of white men, we did not know that three years previously he had crossed the Binue at its junction with the Fáro, not more than 70 miles from the limit of our expedition. It is interesting to remember his description of the noble stream. He says:—"The principal river, the Benuwé, flowed here from east to west, in a broad and majestic course, through an entirely open country, from which only here and there detached mountains started forth. The banks on our side rose to 25, and in some places to 30 feet; while just opposite to my station, behind a pointed headland of sand, the Fáro rushed forth, appearing from this point not much inferior to the principal river, and coming in a fine sweep from the south-east. The river, where we crossed it, was at the very least 800 yards broad, and in its channel generally 11 feet deep, and was liable to rise under *ordinary* circumstances at least 30, or even at times 50 feet higher. The second river, the Fáro, is stated to come from Mount Lábul, about seven days' march to the south. It was at present about 600 yards broad, but generally not exceeding 2 feet in depth, although almost all my informants had stated to me that the Fáro was the principal river. The current of the Fáro was extremely violent, far more so than that of the Benuwé, approaching in my estimation a rate of about 5 miles, while I would rate the former at about  $3\frac{1}{2}$  miles an hour; the current of the Fáro plainly indicating that the mountainous region whence it issued was at no great distance."

At this point we leave the River Binue. What is its origin remains at present unknown, but we have sufficient data to guide us to some general conclusions. From its vast volume, its collecting area must be large. From its extraordinary and rapid rise and fall, that collecting area is probably a mountainous region, and from the comparatively slow current, the fall for a very considerable distance

above Tépé, the point where Dr. Barth crossed, must be very gradual. The River Welle, discovered by the German traveller, Schweinfurth, would seem to answer to these conditions, although he assigns this to the system of the Shary, because no other region could supply the volume of water which that river pours into Lake Tsad. If this is so, the source of the Binue must be sought still more to the south. Now, if the Welle becomes the Shary, which at Lake Tsad has almost exactly the volume and current of the Binue at Tépé, it is not improbable, when we remember the rainfall of this part of Central Africa, that the course of the Binue is about the same length as that of the Shary and Welle. Then, removing its sources sufficiently to the south to allow room for two collecting areas of equal magnitude, we are almost driven to place them about 3° south, and in longitude about 25° east, which is not more than 100 miles from Nyangwè, on the River Lualaba. I am strengthened in this belief by the information furnished me by an Arab trader at Eggan, to which I shall presently refer.

It is somewhat remarkable that in the course of a journey of 700 miles, we come in contact with no less than thirteen different languages. Ten of them are apparently of the same family, and bespeak aboriginal tribes. One, the Mitshi, is apparently aboriginal, but the language is entirely peculiar; while two, the Fulah and Haussa, are languages whose original homes are remote, they have reached the Niger and Binue, the one accompanying Mohammedan conquest, the other in the path of trade.

With regard to the Haussa language, from the prefatory remarks to Schön's Haussa vocabulary, we learn that the territory in which the Haussa is the vernacular language may with some limitation be said to be the Soudan. Sierra Leone contains many of every province of Haussa. Near Cape Coast a little village was pointed out to me to be inhabited by Haussas, and I have met some at the island of Fernando Po; and there is every reason to conclude that the Haussa language has been the only medium of communication and intercourse with people, chiefs and kings, from Badagry to Borgou, Rabba, Boosa, Yaouri, Egga, and down the Niger to the Ibo country. I can corroborate the above statement from my own experience and observation on the River Niger as far as Eggan.

Leaving the west, and passing to the north, it has there also spread far and wide, and obtained the same notoriety as in the west, every traveller bearing testimony to this fact. Clapperton's incidental allusions to the importance of the Haussa language are numerous. Oberweg congratulates the Expedition in having met with an interpreter who was master of Afnu, that is, the Haussa

language. Barth, writing to Professor Lepsius from Ai-Salah, speaks of the absolute necessity of mastering the Hausa language.

At Oru, in the Delta, we already commenced meeting with solitary opportunities of communicating with the people through Hausa slaves. From Abo we engaged a Hausa interpreter, who was very serviceable to us throughout the Expedition. At Idda we found that the Hausa language was becoming more generally spoken by the inhabitants: salutations in that language generally sounded in our ears. At Igbegbe, near the confluence, the Hausa is one of the prevailing languages spoken by the mixed population of that market-town, and it is the chief medium of communication in commercial transactions, though Igbara is the language of the place.

At Yimaha, in the Igbara country, at Oruku, in the Bassa country, at Doma, also among the hitherto unknown Mitshis, among the inhabitants of the extensive Kororofa, and with the Fulahs of Hamaruwa, the Hausa language was the chief medium of communication, both with the chiefs and with the people whom we visited during the late Expedition; and I was told that the knowledge of Hausa will bring any one to Mecca.

All the Mohammedans understand and speak the Hausa language, and through it the Koran is explained and interpreted in their own mosques throughout Yoruba; so that from Lagos, Badagry, and Porto Novo, and upwards to the Niger, where Mohammedans are found, the Hausa language is spoken by them. I may add here, that translational work in this language is proceeding under the care of Mr. Schön.

The other important language of this part of Africa is the Fulah, or Pulo, or Filani, a remarkable people who are found at Timbo and Falaba, on the West Coast, and have pushed their conquests as far as Yola, to the south of Binue. From the preface to a recently published grammar of the language by the Rev. J. C. Reichardt, of the Church Missionary Society, we learn that their wanderings towards the west had taken place about the sixteenth century. We now find a strong Pulo empire in a north-westerly direction, from the upper course of the Jaliba, with a government town at Hamd-Allah. But the larger stream of this inland emigration spread higher up, and occupied Futa Jallo and Futa Toro, with the seat of government at Timbo. These regions the emigrated Fulbe appear to have regarded as the landmarks to their western progress, and they maintain their domiciles within these confines to the present day.

In the course of time when, by the zeal of the ruling *wālis*, the

doctrine of the Prophet had become the national creed of Futa land, the Fulbe, in obedience to the dictates of Alquoran, and emboldened by the increase of numerical strength, agreed upon a holy war, for the coercion of their heathenish, and as yet unbelieving, neighbours and fellow-countrymen. The first attempt of the Fulbe to suppress heathenism became successful, and, with the introduction of the doctrine of the Prophet, the political supremacy of the Futa dynasty over the surrounding territories became established and finally acknowledged. Gradually the warlike spirit of this gifted nation led them to greater success among many contiguous nationalities: their influence is great and their name respected on the banks of the Senegal, the Rio Pongas, the Nunez, the Searcies; they influence the trade far into the interior, at Sego, Buria, Sangara, the so-called gold countries; their importance is felt among the Bambaras and Mandingoes; in the Suleiman, Limba and Koranko countries, and has paved itself open roads and easy ways through the Susus to the Mellacoure, and they have obtained welcome passes through the Timane and Sherbro countries to the British settlement of Sierra Leone. As enterprising traders, they convey the gold-dust and ivory, obtained from the distant Serankules, to the French colonists of the Senegal, and to the stores of the European and mercantile population of Freetown, in Sierra Leone. The Fulbe in their further conquests seem to have been satisfied with the establishment of their imported religion and the expulsion of heathenism, and then, after receiving guarantees for the acceptance of their Protectorate, to have withdrawn their numerous armies to the confines of their fertile homes of Futa Jallo and Toro. This interesting nation now occupies a territory, both irregular and wide-spread, towards the interior; according to Dr. Barth, there is a considerable part of them in Adamawa; they are in power at Sokoto, and there is ample proof of their being largely mixed with the Hausa nation.

Ever since the times of Denham and Clapperton, the warlike Fulahs or Filani have continued their hostile and predatory attacks on the more peaceful tribes—towns are still destroyed, and it is their frequent attacks which unsettle the tribes, and render them suspicious of the presence of strangers.

I now beg to offer a few remarks on the trade-routes which meet at Eggan on the Niger. The chief routes are those which come from the north, from Tripoli, across the Sahara, bringing European produce on camels as far as Kano, and thence by donkeys to the Nupe kingdom, whence the goods are dispersed into the adjoining countries. Another route comes from the far East, apparently from the countries on the Upper Nile. With one of these caravans we

saw two camels which bore the English broad arrow, and we understood they had been used in the Abyssinian Expedition. Other caravans trade to the south-east. When I was in Eggan in 1852, I met a Hausa trader, who told me he had seen an old white man in a canoe on a lake; that he saluted him; and the white man had come to him and asked him why he saluted him. He described the white man as wearing white whiskers and having a red shirt and overall boots. I did not at the time gather from him how long before that it was that he had seen the white man, but I found last year that the journey must have occupied nearly two years, so that it may have been in 1869 or 1870 that he saw the traveller. Thinking it might possibly be the traveller Livingstone, I gave the trader a letter, with instructions to deliver it, and bring me back the reply. I never heard of the man until last September, when I was at Eggan; I found that the man had returned. My son saw him, and on asking about the letter, he told him that he had been to the same place, and there he had been told that the white man was dead, so he brought back the letter. My son asked him some questions; among others, what was the name of the water where he had seen the traveller, and the answer was, Tanganyika. The people at the side of the lake he described as very wild and fierce. The route taken seemed to be on the northern and western shore; then, turning southwards, was along the bank of the Binue, and no large river or mountain chain seems to have been crossed. If this is so, it would seem that the Binue turns to the south-east, running parallel to the upper course of the Bahr Kuta, or Welle.

In conclusion, I would remark that so good is the feeling towards the English among the rulers to the north of the Binue, that there is every opportunity for the introduction to a larger extent of British commerce; and though the Government have not continued the Niger Expeditions, and have withdrawn the Consular authority from the confluence, the fruit of the former policy is now being found.

Further attempts, carefully planned, and entrusted to men who would conciliate and not alarm the natives, would carry geographical discovery far to the interior; while the labours of Messrs. Schön and Reichardt, in reducing the Hausa and Fulah languages, have rendered most important assistance to the future traveller in these regions by putting him in possession of these keys to the interior of Africa.

Mr. HUTCHINSON said the Church Missionary Society was very anxious to give Bishop Crowther every facility for the purpose of continuing his

work, and that morning they had agreed that the circumstances were of such importance as to justify them in assisting the Bishop to procure a steamer to enable him to proceed still further up the Binue. It was hoped that stations would be occupied as far as Yola. The policy of the English Government in former days, although at the time accompanied by disaster and defeat, had produced results which were now very manifest in the friendly feelings of the natives towards Englishmen. The steamer, which had just been ordered from a well-known firm in the North, would draw 3 feet 6 inches of water, and the guaranteed speed would be 10 knots an hour. If the conclusions in the Paper were correct, they might expect to find a navigable river for some considerable distance, and perhaps through the centre of the only unexplored portion of the African Continent. It was very remarkable that the native traveller whom the Bishop had met should have himself mentioned the name of Tanganyika. Whether his statement was true or not, there could be little doubt that the Binue was of considerable length; and it was to be hoped that the little steamer, with which the Bishop would be supplied by the early part of next year, would greatly assist in solving the question of whence the Binue came. If its source lay within 100 miles of Nyangwe, it was not at all impossible that some portion of the Lualaba might find its way into the Binue. In this work the Church Missionary Society bespoke the interest and sympathy of the Geographical Society. The Missionary Society trusted that some day their operations would reach right across the continent, and, so far as could be seen at present, the Binue would form an important link in the chain.

The PRESIDENT said he had been very much struck by some of the Bishop's observations on the progress of the Mohammedan religion among the conquered races, and he wished to know what was the real effect of Mohammedanism upon the natives—whether it did in any sense purify and improve the social position and disposition of those who became subject to it. Mohammedanism had made such vast progress in Africa, that it was a matter of grave interest to know what was the influence of a religion which seemed by its simplicity, at least, to recommend itself to the African mind. There could not be a more striking example of how far the influence of one man might extend in those regions than the fact that the native women sang songs in praise of Glover. It had been said very wisely by some one, that others might write the history of a nation if he might write the songs; and when songs in praise of an Englishman found their root in Central Africa, it was very certain that the influences of Christianity and commerce would not long halt behind. He wished to ask Bishop Crowther how far he thought it possible that, if the tribes among whom he had travelled were once secured from predatory inroads, they might be converted into peaceable, industrious nations? For no one could doubt that the true means of combating slavery, and putting an end to the slave-trade, was to be found in legitimate commerce.

Bishop CROWTHER replied, that Mohammedans had done some good among the natives, for, as far as they dared do it with safety, they had abolished the worship of idols and the offering of human sacrifices; but if they had mingled charity with their teaching, the natives would have more firmly adhered to them. They, however, were very oppressive. They were slave-holders, and their object now was not so much to proselytise as to enslave, and the populations under their sway disliked them exceedingly. When he first established a Christian mission at the confluence of the two rivers, the Mohammedans attended the place of worship; but though they had been masters of the country to his own knowledge since 1841, no sooner did the Christian Mission go there, than the heathens voluntarily erected a shed, and invited him to preach the Gospel to them. Both that shed and a second were accidentally

burnt down, but the natives rebuilt it, and worship was still conducted there. Travellers very often made a mistake as to the religion of these tribes. From Abco to the Yoruba country the dress of the people was the flowing toga; and because Mohammedans wore a similar dress, travellers sometimes concluded that the people were Mohammedans. That conclusion was not correct. Since Trotter's Expedition, in 1841, the Mohammedans had been masters of the Nupe country; but two years ago Umoru permitted him to build a station near the head-village, and it was found that out of a population of 500, there had not been a single convert to Mohammedanism, the people remaining idolaters, though they wore what were regarded as Mohammedan clothes. British influence in those regions was very great. This moral influence arose from their liberating slaves, who, on their return to their own districts, spread the name of England far and wide; and even the Mohammedans could not but admire the principle which actuated the British Government. He himself was the only person connected with Trotter's Expedition who was still working on the Niger, and both the late King Masaba, and the present King Umoru, asked him to tell the British Government that they wished to pay every possible attention to their subjects. The Sultans of Sokoto and Gondu were also extremely well disposed towards Englishmen, who might travel from the banks of the Niger to Sokoto or Gandu without being interfered with. Because he himself was an English subject, he had access to every part of the country.

Sir FOWELL BUXTON said he supposed he should be telling no secret when he alluded to the fact that the Geographical Society was making very special efforts to carry out on a systematic basis the exploration of Africa. By the establishment of an African Exploration Fund it was hoped that something might be done in a clear and definite way. If Englishmen were to take the lead in this work, they ought not to neglect the very great help which might be obtained from Africans. The Society had lately been doing their best to pay honour to a distinguished native of India who had told them much about the geography of the countries to the north of the Himalaya; and no doubt much information could be obtained by using the intelligence and the wits of African natives. It was manifest that there were many parts of Africa where Europeans could not travel in safety to their health, while the natives could go there at comparatively little risk, and it was worth while for the Church Missionary Society and the Right Rev. Bishop of the Niger to take some little pains to see if Africans could not be educated and trained for the special purpose of carrying out exploration. It would be remembered that last September a party assembled at Brussels from many countries of Europe, the one bond of union being that they all took an interest in the exploration and development of Africa. It was there agreed that for the purpose of civilising Africa it was very important that lines of communication should be opened up, and that the navigable rivers should be ascertained and used. It was remarkable how much of this work had been done by missionaries. In India traders led the way; but Colonel Grant and other African travellers would acknowledge that their first start was suggested by the maps that were sent home by the missionaries Krapf and Rebmann.

The DEAN OF LICHFIELD wished to take this opportunity of moving a vote of thanks to Bishop Crowther for his attendance that evening, and for the interesting observations he had addressed to the Meeting. When he himself joined the Society, while he fully appreciated its value as a means of laying open some of the secrets of this globe on which we live, he felt very strongly as a clergyman that it was the most effectual instrument for forming a highway for Christianity. He hoped that Bishop Crowther was the representative of a new race of native African bishops who, with enlightened knowledge and judgment, might be pioneers of those who should still further



explore the vast continent of Africa. His opinion was that Christianity would never really flourish in any land until it was led by the native blood.

Mr. FRANCIS GALTON asked what commercial use was made of the Niger and its two branches? How many European ships ascended the stream yearly? Did any ascend the Chadda? And what was the amount of exports?

Bishop CROWTHER, in reply, said at Egga, the limit of Trotter's Expedition, 360 miles up, about 46 tons of ivory were collected last year. When Mr. Macgregor Laird attempted to open up trade on the Upper Niger in 1857, only five casks of Shea-butter were collected, but during the past year 2000 casks were brought down. Between 5000 and 6000 casks of oil were also exported. Instead of the small steamers carrying 80 or 100 casks, large vessels were now being built to carry from 400 to 600 casks. There were about six steamers engaged in the trade, and they made five or six trips every year.

Mr. EMIL BRASS asked if Bishop Crowther had met with any traces of the dwarf race first met with by Dr. Schweinfurth, and afterwards by Dr. Bastian, on the Gaboon.

Bishop CROWTHER said he had met with very small individuals in different tribes, but not with any race of dwarfs.

The PRESIDENT said he cordially joined in the vote of thanks which had been proposed by the Dean of Lichfield. He did so with the greater readiness because he entirely agreed with him that no true progress would be made by Christianity in heathen lands which was not led by the native mind itself. The object should be to educate a minority, and teach them, by means of a European language, the truths of Christianity. Such teaching would then percolate through the native mind and take the vernacular form of expression, and in this way alone could Christianity spread among the tribes.

The following Paper was then read by the Author:—

*2. Progress of the Victoria Nyanza Expedition of the Church Missionary Society.* By EDWARD HUTCHINSON, Esq.

THE Society having decided that its approach to the Victoria Nyanza should be by the East Coast, it was determined that intermediate stations should be formed, and that parties should go contemporaneously to King Rumanika at Karagwe, and King Mtesa at Uganda. The points agreed upon for intermediate stations were Mpwapwa and Meninga. Attention was turned to the possibility of utilising one of the Eastern Africa Rivers.

The information furnished by Mr. Stanley as to the Wami River seemed to be supported by the views of Captain Speke; and the survey made under Sir Bartle Frere in 1872 of a portion of the stream determined the Committee to attempt this river, and also the Kingani, the head-waters of both rivers being not very far from Mpwapwa. A suitable boat was accordingly built, and both the Wami and Kingani were explored.

The following extracts from the Journal of Lieutenant Smith and Mr. Mackay satisfied us that the Wami is never likely to fulfil the part assigned to it by Mr. Stanley.

"Mackay and I left Zanzibar in the *Daisy* on the 12th, taking with us Bombay and a crew of fourteen men. Anchoring at Saadani for the night, and taking in a supply of coal previously sent across, we started in the morning for the Wami, which lies about 4 miles to the southward. Entering the river, we found plenty of water—6 to 7 feet—and had a current of  $2\frac{1}{2}$  miles to contend against, which, in the narrows and bends, increased to 3 and  $3\frac{1}{2}$  miles.

"The river is very tortuous, doubling oftentimes back on itself, so that you find the hills, which were in your front one minute are seen over the stern in the next. This tortuous character attaches to the river as far up as we went—about 60 miles—and renders the navigation difficult, owing to the sharp bends and curves which are met with at every 100 yards.

"As we ascended the river the country became more open and hilly, and apparently better populated, although no village of any size was seen on its banks. Fowls, goats, and sheep, were not plentiful, and high prices were charged accordingly. Indian corn and sugar-cane were cultivated.

"As far as we could learn from the aged natives, no trade by boats had ever been carried on. They all pointed to its tortuous course as a reason for preferring the road to the river. We found that, after toiling all day, and covering perhaps 20 miles of water, we had only advanced two hours of actual distance from point to point.

"After five days we had reached a point only 15 miles by land from Saadani; I therefore decided to return, as I saw no prospect of our being able to utilise the river.

"1. The current is too rapid for our rate of speed. 2. The river is so tortuous, that a land-journey could be performed in half the time. 3. It was falling so rapidly that, had we succeeded in getting up, it would have been doubtful whether we should have sufficient water to return.

"The river, in my judgment, is useless for purposes of trade, and I very much question that it has ever been used as a means of conveying goods to the coast."

Having left the Wami, the party were accompanied by Vice-Consul Holmwood, and an attempt to explore the Kingani was then made. This river, too, as a navigable stream, is worthless. Consul Holmwood's report is full of interest, and the following extracts may be acceptable—

"The Rufu, or Kingani, is, as a navigable river, at present simply worthless. Its course is so tortuous that, in ascending 48 geographical miles from point to point, 115 miles of water are traversed, the distance by road to the same position not being more than 70 miles.

"Beyond the tidal limit the stream is everywhere rendered dangerous by sunken snags and fallen trees. The river, though deep, soon narrows to about 20 or 25 yards in most places, making it very difficult for any but a short boat, and one having high steam-power, to get round the numerous sharp bends, where the current often increases to a rapid. Still more hazardous is the descent; indeed, with six oars and both screws working, the *Daisy* was more than once taken out of all control by the current, and dashed against the banks, or on some obstacle in mid-channel; in one instance the huge limb of a tree going through her sides, and the water filling the engine-compartment instantly.

"By such accidents, which would always be incidental to navigation in this river, we were delayed several days, and greater inconvenience and loss of time were occasioned thereby than would be incurred in the ordinary accidents of land-travel.

"The river, moreover, is only open for navigation from about 1st of June till the end of August; for though in most years it might be ascended in December or January—the rains in Usagara coming on about that time—yet to be caught in a flood would be most dangerous, as not only is the body of water irresistible, but large trees are swept down before it, and in many places the bed is subject to be suddenly shifted.

"At the beginning of September the river subsides to a fordable stream, except where deep still holes have formed, or when an occasional freshet comes down during the lesser rains.

"The Lungerengere is a deep but narrow feeder of the Kingani. Confined by steep banks, it is a torrent during the rains, but rapidly subsides, and when we reached it the stream was from 12 feet to 20 feet broad, with a depth of about 2 feet. This induent, however, is unnavigable at all times, even by canoes. Its chief interest lies in the great extent of its course and violence of its floods. It dries up in September.

"Such is the general description of the Kingani and Lungerengere Rivers. That of the adjacent country and its inhabitants may, possibly, prove more interesting to your Society, and will best be illustrated by a brief sketch of our trip, and particularly of the people we came in contact with.

"Up to the ferry of Meituwambiji, on the Ukami road, the people dwelling on both banks are Swahili, or slaves cultivating the plantations of proprietors resident at Bagamoyo, and mostly professing Mohammedanism. Shortly beyond this, Wazaramo villages commence. The first signs of these were small groups of women and children on the banks, attended by a few more than half-naked savages, each carrying a bow and two poisoned arrows ready in hand, with a leathern quiver of the same at his back. These warriors generally knelt in the tall grass, or behind a bush, until the women reported that there was no danger. They have the head hideously thatched with a mixture of black clay and oil, with beads or drops of the same at the ends of the rat-tailed-shaped points of hair which fringe it; their legs and arms are encircled with heavy brass and copper rings, a few ornaments of beads or white shells adorning their ears and necks. Both bows and arrows are most workmanlike in make and finish. The poison extends for about  $\frac{1}{4}$  inches below the barb; when fresh it is of a bright-red colour. They told me it is prepared from the giant euphorbia, and that their medicine men provide them with a perfect antidote for it; but I failed to learn the nature or to procure a specimen of this compound.

"Many of the children are got up in the same way as the men, carrying, however, miniature bows and arrows, the latter tipped with hard-wood points, and the shaft stained red where the poison should be.

"But this warlike appearance seems only a keeping up of the customs of a generation now rapidly passing away. On closer acquaintance, these fierce-looking persons were found to be generally of a timid disposition, and by no means prone to an indiscriminate use of their weapons. Whenever a herd of hippopotami in the channel rendered it necessary to sound the steam-whistle, or the donkey-engine was turned on, they instantly fled for the nearest cover, or carefully got the women and children between themselves and the supposed danger, and rarely showed again unless the boat stayed a time for wood or provisions, when they were the last to draw near.

"Beyond Mafizi there are few people, except at the junction of the Lungerengere, near which are many villages. Here the population becomes mixed in race, as also in their language. In each village there were Wakutu, Wakami, and Wazaramo. This country is full of game; everywhere, a few miles from the villages, are to be seen giraffe, brindled 'gnu, water-buck, hartebeeste, &c. On a fine park-like plain, on the banks of the Lungerengere, we saw four or five herds of giraffe feeding within a few hundred yards of us,

besides water-buck and other game, and in the evening a large herd of 'gnu going to drink at the river. We were also told of an elephant-forest one day distant, and among the low hills, a few miles beyond the giraffe-plain, rhinoceros and buffalo are said to be plentiful. This country was populous and thriving a few years since, before the incursion of the Maviti; now the only traces we found of former prosperity were the charred remains of numerous villages, strewn with fragments of household utensils, and indications of large plantations now rapidly lapsing to jungle.

"I may mention the fish of the Kingani as being very numerous and of fine quality. Wherever the banks are low, they are lined with weirs and fish-traps of most skillful construction.

"During our journey we happily had no trouble with the natives. There were a few requests to know who we were, who, in defiance of all custom, passed without stopping to see the chief, or get permission to enter the country, and a mild hint sometimes was given about hongo, but was not noticed. We were, however, well provisioned, and to a great extent independent of the country, otherwise we should have been compelled to pay prices that would have been equivalent to giving hongo.

"Your Committee will, I feel assured, be glad to learn that the special work in connection with the slave-trade suppression, for which Dr. Kirk despatched me to the coast, was much facilitated by the opportunity afforded by the visit to the Kingani of the *Daisy*, a passage in which you had so kindly offered me when preparing yourself to conduct the exploration.

"Before concluding, I will endeavour briefly to sketch the character and customs of the population through which we passed—points on which I know you are desirous of obtaining information.

"I am by no means able to confirm all that is said against the Wazaramo; on the contrary, I am led to think that, for Africans, these people are unusually industrious and domestic in their habits, and, in regard to morality, far in advance of what is generally found in Africa.

"The women, though made to do out-door work, are treated, as well as spoken of, in a becoming manner, and every one is perfectly clean; the huts being beautifully kept inside, and the open space in the centre of each hamlet well swept, and often having a bench for the elders, around whom it was customary for the young men to congregate during leisure hours.

"The Wazaramo appear to have no religion, unless a lively faith in evil spirits and witchcraft can be so termed. Miniature huts, containing charms against the secret dangers of the seen and unseen world, guard the entrances to every village, and incantations for securing success are performed before every important undertaking. A specific from the medicine-man also protects every hut and patch of cultivation, and there is no doubt of its efficacy against thieves among themselves, when all believe in its power. The people, however, are practical agriculturists. Against the depredations of the hippopotamus and pig they erect strong barriers and dig deep pits; and in one of the latter we temporarily lost Mr. Mackay, who, stepping on shore for the purpose of choosing a tree for fuel, suddenly disappeared. Fortunately, the pitfall was only about six feet deep, and no spikes at the bottom, so he escaped with nothing more than a severe shock; but many of the traps are as dangerous as they are deceptive in appearance.

"Mohammedanism has begun to make way among the people, and, should the country become opened, is certain to rapidly spread. Already in most villages there are a few idle fellows who strut about with shaven heads, and, making use of Arabic salutations, trying with poor success to imitate the grave bearing of some true believer whom they may have been associated with during a journey, or have met at a coast town. They are, however, looked upon as something superior by their fellow-villagers, whom they behold

with pity and contempt, although quite unable to teach the new doctrine. If, however, this part of Africa should be visited by coast traders, the arrival of educated Arabs would soon bring about the conversion to Mohammedanism of this hitherto exclusive country.

“Slavery in Uzaramo is only known in its least objectionable form. Captives in war, runaways from foreign masters, and even strangers permitted to reside and cultivate land, are called slaves; but, except for committing a crime, are not subject to be sold; and their status in no way differs from that of free men, except that they are for the first year or two on trial, and generally cultivate land assigned to them by the chief, somewhat stronger feudal liabilities being probably entailed thereby. If, after probation, they are approved by the inhabitants, and considered by the elders as an addition to the tribe, they readily obtain wives, and their children become free Wazaramo.”

Abandoning the hope of utilising either of these rivers, the Mission party started in four divisions from Mpwapwa. The first started on the 14th of July. These were intended to commence the station at Mpwapwa. The remaining divisions started at the end of August and on the 14th of September. Leaving Bagamoyo they struck almost due west, making for the Wami, which they crossed by a capital suspension bridge. The river was 65 feet broad, and 5 feet 8 inches deep in mid-stream. A little below this point one of the party at a subsequent time came upon some rapids in the Wami, which would be an effectual bar to navigation. After crossing the Wami, the route of Mr. Roger Price was followed, and Mpwapwa was reached after about thirty-six days' march. Here a site was selected, and a commencement was made for the erection of a house. Two of the party remained here, and the rest passed on.

Before reaching Mpwapwa there was an alarm of the Masai, but they retired. Acting upon the discretion left to the leader of the party, it appears to have been resolved to make as soon as possible direct for the Lake, and ascend the Kitangule River by means of the steam-launch which was being carried with the party.

At Mukondoku the party turned to the north, and followed pretty nearly the route of Mr. Stanley's march to the southern end of the Lake.

At Mukondoku they received friendly messages from Mirambo, who appeared to be fighting some one, but would not interfere with any white man. None of the party make any reference to the fighting and bloodshed described by Mr. Stanley.

They reached Mgongo Tembo (lat.  $4^{\circ}44'$ , long.  $33^{\circ}58'$ ) on December 2nd; and Nguru (lat.  $4^{\circ}11'$ , long.  $33^{\circ}20'$ ) on December 10th. Here a large number of desertions took place, and Lieutenant Smith, the leader of the party, was compelled to march down to Unyanyembe to obtain quarters and cloth. Here he

was detained for a whole month, but rejoined the party at Nguru; and they altogether started for the Lake towards the end of December.

They reached Kagéi (*Kagehi* of Stanley) on the Lake, after thirty-one days' journey. The following extract from the Journal of one of the party announces their arrival:—

“Kagéi, January 29th, 1877.

“I am now able to announce our arrival at the Victoria Nyauza, after a rather tedious journey of thirty-one days from Nguru, the distance being about 125 miles. We had expected to have accomplished this stage in fourteen or sixteen days, but, owing to the many delays which we experienced from our pagazi, stopping at villages from various causes, sometimes sickness, but more frequently whim, we could not get on; and were obliged to submit, or they would leave us in a worse plight by running away from us. The whole distance travelled over is studded with villages, nicely situated and surrounded by green hedge-rows of euphorbia; altogether, the country is a fine open one, with much cattle and well-cultivated, every village having a considerable breadth of land sown with Indian corn or millet, and everywhere water is abundant. I should say it would by proper management become a very rich country; but the great drawback is the absence of any king or ruler recognised over the entire country. Kings there are in abundance, for every village we passed had one, but there is no central authority.

“We are now at a place where Stanley had his camp, and where one of his men died and is buried—the grave marked by a stone, inscribed ‘*P. B., 1875, Stanley's Ex.*’ As yet I cannot say if it will suit our purposes of boat-building, &c., because, having arrived only this day, we have not as yet examined the country about us as regards the timber. From what I have been able to see, there does not appear to be very much in this neighbourhood, and the king of this place, in conjunction with Songoro, the slave-trader, is building a dhow on the island of *Ukereue*, opposite to us. This has been in progress for the last three years, and is not yet finished: this is the same vessel referred to by Stanley last year.”

Of the two who were left behind at Mpwapwa one has been compelled to return home for a temporary recruit, and the other, Mr. Mackay, was busily engaged in the construction of a rough road from Saadani and Mpwapwa.

Dr. MAXN said Nyangwe, which lay on the frontier of the unknown land, was first brought to the notice of Europeans by the fact that Livingstone

remained there some time. A little while after, Cameron was at the same place. Since then news had arrived that a German explorer, Dr. Pogge, had been in the neighbourhood. Livingstone was convinced that the river there found its way to the Mediterranean by way of the Nile; Cameron was as firmly convinced that it was the Congo; the German traveller believed it to be connected with the Ogowé; and now this evening a fourth supposition was advanced, that it was one of the feeders of the Niger. Livingstone's opinion might be regarded as one of the things of the past; and there were, therefore, three alternatives remaining open for choice. If, however, the Church Missionary Society once got as firm a grasp of Ujiji as they evidently had of the district between Zanzibar and Mpwapwa, the mystery of the destination of the river at Nyangwe would soon be solved. There was also, in the face of the energetic explorations that were in progress on the great rivers, certainly a strong chance that it might yet be reached by the ascent of one of the Atlantic rivers.

The PRESIDENT said he was quite sure the Meeting must wish all success to the praiseworthy efforts of the Church Missionary Society, for both Geography and Commerce would be benefited by their labours. He believed that in a very few years the map of Africa to the west of the Tanganyika would be as complete as that between the great Lake and the East Coast. The Geographical Society was not likely to lose heart in their exertions to attain such a desirable end.

*Fourteenth Meeting, 25th June, 1877.*

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*The Marchese Bianchi* (Mem. Ital. Geogr. Soc.); *Donald Currie, Esq., C.M.G.*; *Raikes Currie, Esq.*; *Captain George Edward Grover, R.E.*; *Charles Gardiner, Esq.*; *John Ambrose Ridgway, Esq.*; *W. H. Tietkens, Esq.* (Govt. Surv. S. Australia).

DONATIONS TO LIBRARY, 11TH TO 25TH JUNE, 1877.—China, von Ferdinand von Richthofen, vol. i. (*Author*). The Encyclopædia Britannica, 9th edit., vol. vi. (*Messrs. A. and C. Black*). *Projet de création d'une Colonie Agricole Belge dans l'Afrique Centrale*, par E. Reuter (*Author*). *Notice Nécrologique sur M. le M<sup>r</sup> de Compiègne*, par C. Guillemine (*The Khedivial Geographical Society*). Report on the trade of Kiukiang for 1875, by H. Kopsch (*Author*). Descriptive Notes on Papuan plants, Nos. 4 and 5, and *Fragmenta Phytographiæ Australiae*, No. LXXXVI., by Baron F. von Mueller (*Author*). *Die Stammverwandtschaft der meisten Sprachen der alten und australischen Welt*, von D. E. D. Europæus (*Author*). The Arctic Expedition of 1875-76; a Reply to its critics, by Admiral Richards (*Author*). The Eastern Question in its Anglo-Indian aspect, by Rev. J. Long (*Author*). Records of the Geological Survey of India, x., pt. 2 (*Dr. Oldham, for the Indian Government*). U.S. Geological Survey of Territories, List of elevations,

4th edition (*Dr. F. V. Hayden*). Climate of New South Wales, by H. C. Russell (*Author*). Travels in the Valley of the Obi, by J. S. Palyakoff, in Russian (*Author*). The route to Bolivia via the river Amazon, by Col. G. E. Church (*Author*). North-east Madagascar, by J. A. Houlder (*Author*). Atjeh en de Atjehers, door J. A. Kruijt (*Author*). Selections from the Records of the Madras Government, No. L.; Papers relating to Survey of the Trichinopoly district (*H.M. Sec. of State for India*); and the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM, FROM 11TH TO 25TH JUNE, 1877.—Map of Turkish Armenia, and map of distribution of religions in Bosnia and Herzegovina, by H. Kiepert (*Author*). Map of route from Foga to El Obeiyad, by Major Prout (*General Stone*). Map of routes travelled and discoveries made by Ernest Giles in South and Western Australia.

On introducing the subject of the evening, the PRESIDENT said the Society was highly honoured by the presence of His Majesty the Emperor of Brazil, who had come to hear the last of the series of scientific lectures for this session. The subject of the lecture was one of extreme interest, and of larger scope even than its predecessor. Mr. Wallace, whose name was so well known among all naturalists as well as physicists, had been good enough to undertake to address them on the antiquity of the continents as illustrated by their animals, both extinct and living. This, of course, was a very wide subject, and he was sure that after listening to Mr. Wallace the meeting would be of opinion that Physical Geography never took a more attractive form than when it was treated in its most scientific aspect, united both with geology and natural history, showing what the surface of the earth now was, and how it had been modified from what it was in ages far back.

The following Lecture, the third of the Session, was delivered by the author:—

*The Comparative Antiquity of Continents, as indicated by the Distribution of Living and Extinct Animals.* By ALFRED RUSSEL WALLACE.

It may be truly said, that Geography and geographical discovery owe much of their interest to the peculiarities of animal and vegetable life that characterise remote countries, and which frequently give them an altogether distinctive character. The camel and the date-palm are intimately associated with the Syrian and Arabian deserts; the elephant, the tiger, and the deadly cobra, are suggested to us whenever we speak of India; while the lion, the giraffe, and the antelopes are no less closely associated with Africa. We can hardly think of Brazil without picturing to ourselves its sloths, its humming-birds and its toucans; or of Australia without its kangaroos and its gum-trees.



If we study the distribution of animals and plants in greater detail, we find that these general and more popularly-known relations of organic forms to the countries they inhabit, are supplemented by a whole series of less conspicuous, but not less remarkable facts, all going to show the existence of intimate yet complex relations between the earth and its inhabitants. We find that each continent, each island, and, generally, every tract of land marked out by natural boundaries or by peculiarities of soil and climate, is distinguished by a more or less peculiar flora or fauna.

It was very soon ascertained that some of the facts of distribution were due to diversities of climate, of altitude, and of geological structure as determining the nature of the soil; but as observations multiplied it was found that only some of the general features could be thus explained, leaving a mass of interesting details quite unaccounted for. Further inquiry showed, that a far more important cause of the phenomena was the existence of barriers which limit the range and migrations of organisms, such as oceans, seas, mountains, deserts, swamps, and forests. But still, something more was wanted to enable us to explain, or even to comprehend the import of the facts, and this want is supplied by those grand views of the course of nature associated with the names of Lyell and Darwin—on the one hand of slow but never-ceasing changes in the physical conditions, the outlines, and the mutual relations of the land-surfaces of the globe: and on the other hand, of equally slow and never-ceasing changes in the forms and structures of all organisms, to a great extent correlated with, and perhaps dependent on, the former changes. Combining these two great principles with the other ascertained causes of distribution, we are at length enabled to deal adequately with the problem before us, and give a rational, though often only an approximative and conjectural solution of the many strange anomalies we meet with in studying the distribution of living things.

Having thus obtained a clue which enables us to unravel the complex causes which have determined the range and limitations of the more important groups of animals, and having tested its application in a variety of critical cases,\* we feel justified in applying the same rules and arguments inversely, so as to make the facts of distribution in present and past time yield us some information as to the changes in Geography which have produced them, thus supplementing in some degree the fragmentary indications afforded by Geology and Physical Geography. A new interest is thus given to the study

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\* See the Author's 'Geographical Distribution of Animals.' 2 vols., 1873.

of the earth's surface. We learn which of its features are of comparatively recent origin, and which are more ancient and more permanent; and we are enabled to trace some of the later steps in the long series of changes by which our continents and islands, and our more important isthmuses and straits, have acquired their present outlines. It is this branch of the subject which I now propose to discuss, though necessarily in brief and rapid outline, dwelling especially on the more important general results to which it conducts us.

The extreme inequality with which land and water is distributed has often been remarked, but what is less frequently noted is the singular way in which all the great masses of land are linked together. Notwithstanding the small proportion of land to water, the vast difference in the quantity of land in the northern and southern hemispheres, and the apparently hap-hazard manner in which it is spread over the globe, we yet find that no important area is completely isolated from the rest. We may even travel from the extreme north of Asia to the three great southern promontories,—Cape Horn, the Cape of Good Hope, and Tasmania—without ever going out of sight of land; and, if we examine a terrestrial globe, we find that the continents in their totality may be likened to a huge creeping plant, whose roots are at or around the North Pole, whose matted stems and branches cover a large part of the northern hemisphere, while it sends out in three directions great offshoots towards the South Pole. This singular arrangement of the land surface into what is practically one huge mass with diverging arms, offers great facilities for the transmission of the varied forms of animal life over the whole earth, and is no doubt one of the chief causes of the essential unity of type which everywhere characterises the existing animal and vegetable productions of the globe.

There is, moreover, good reason to believe that the essential features of this arrangement are of vast antiquity, and that throughout much of the Tertiary period, at all events, the relative positions of our continents and oceans have remained the same, although they have certainly undergone some changes in their extent, and in the degree of their connection with each other. This is proved by two kinds of evidence. In the first place, it is now ascertained by actual measurement that the depths of the great oceans are so vast over wide areas, while the great elevations of the land are limited to comparatively narrow ridges, that the mass of land (above the sea-level) is not more than  $\frac{1}{36}$ th part of the mass of the ocean. Now we have reason to believe that subsidence and elevation bear some kind of proportion to each other, whence it follows that although

several mountain ranges have risen to great heights during the Tertiary period, this amount of elevation bears no proportion to the amount of subsidence required to have changed any considerable area of what was once land into such profound depths as those of the Atlantic or Pacific Oceans. In the second place, we find over a considerable area of all the great continents fresh-water deposits containing the remains of land animals and plants; which deposits must have been formed in lakes or estuaries, and which therefore, speaking generally, imply the existence in their immediate vicinity of land areas comparable to those which still exist. The Miocene deposits of Central and Western Europe, of Greece, of India, and of China, as well as those of various parts of North America, strikingly prove this; while the Eocene deposits of London and Paris, of Belgium, and of various parts of North and South America, though often marine, yet by their abundant remains of land-animals and plants, equally indicate the vicinity of extensive land-areas. For our purpose it is not necessary to go further back than this, but there is much evidence to show that throughout the Secondary, and even some portion of the Palæozoic periods, the land-areas coincided to a considerable extent with our existing continents. Professor Ramsay has shown\* that not only the Wealden formation, and considerable portions of the Upper and Lower Oolite, but also much of the Trias, and the larger part of the Permian, Carboniferous and Old Red Sandstone formations, were almost certainly deposited either in lakes, inland seas, or extensive estuaries. This would prove, that throughout the whole of the vast epochs extending back to the time of the Devonian formation, our present continents have been substantially in existence, subject, no doubt, to vast fluctuations by extension or contraction, and by various degrees of union or separation, but never so completely submerged as to be replaced by oceans comparable in depth with our Atlantic or Pacific.

This general conclusion is of great importance in the study of the Geographical distribution of animals, because it bids us avoid the too hasty assumption that the countless anomalies we meet with are to be explained by great changes in the distribution of land and sea, and leads us to rely more on the inherent powers of dispersal which all organisms possess, and on the union or disruption, extension or diminution, of existing lands—but always in such directions and to such a limited extent as not to involve the elevation of what are now the profoundest depths of the great oceans.

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\* 'Nature,' 1873, p. 333. 'Quarterly Journal of the Geological Society,' 1871, pp. 189 and 241.

We will now proceed to sketch out the zoological features of the six great biological regions, and will afterwards discuss their more recent changes in accordance with the principles here laid down.

The Palaearctic, or North Temperate region of the Old World, is not only by far the most extensive of the zoological regions, but is the one which agrees least with our ordinary geographical divisions. It includes the whole of Europe, by far the largest part of Asia, and a considerable tract of North Africa; yet over the whole of this vast area there prevails a unity of the forms of animal life which renders any primary subdivision of it impossible, and even secondary divisions difficult. But besides being the largest of the great zoological regions there are good reasons for believing this to represent the most ancient, and therefore the most important centre of the development of the higher forms of animal life,—and it is therefore well to consider it first in order.

In enumerating the most important animal groups characteristic of this and other regions, it must be clearly understood that such groups are not always absolutely confined to one region. Here and there they will often overlap the boundaries, while in other cases single species may have a wide distribution in one or more of the adjacent regions; but this does not at all affect the main fact, that the group in question is very abundant and very widely spread over the region in question, while it is very rare, or confined to a very limited area in adjacent regions, and is therefore specially characteristic of the one as compared with other parts of the world. Bearing this in mind, we shall find, that the Palaearctic region is well characterised by a considerable number of typical groups, although, as we shall presently see, it has, in recent geological times, lost much of its ancient richness and variety of animal life.

Among Mammalia the groups most characteristic of this region are the moles (*Talpidae*), a family consisting of eight distinct genera which range over the whole region, but beyond it barely enter the Oriental region in North India, and the Nearctic region in North-West America; camels, confined to the deserts of North Africa and Asia; sheep and goats (*Capra*), only found beyond the region in the Nilgherries and Rocky Mountains; several groups of antelopes, and many peculiar forms of deer; hamsters (*Cricetus*), sand rats (*Psammomys*), mole rats (*Spalax*), and pikas (*Lagomys*) with several other forms of rodents. Wolves, foxes, and bears, are also very characteristic, though by no means confined to the region.

Among birds the most important group is certainly the small-sized, but highly-organised warblers (*Sylviidae*), which, although

almost universally distributed, are more numerous, and have more peculiar and characteristic genera here than in any other region. Most of our song-birds, and many of the commonest tenants of our fields, woods, and gardens, belong to this family, and identical or representative species are often found ranging from Spain to China, and from Ireland to Japan. The reedlings (Panuridæ), the tits (Paridæ), and the magpies (*Pica*), are also very characteristic; while among the finches (Fringillidæ), a considerable number of genera are peculiar. A large number of peculiar groups of grouse (Tetraonidæ), and pheasants (Phasianidæ) are also characteristic of this region. Although the reptiles and fresh-water fishes are comparatively few, yet many of them are peculiar. Thus, no less than 2 genera of snakes, 7 of lizards, and 16 of batrachia, are confined to the Palearctic region, as well as 20 genera of fresh-water fishes.

The insects and land-shells offer their full proportion of peculiar types, but it would lead us beyond our special object to enter into details with regard to these less known groups of animals. Some of the more important will however be found enumerated in the subjoined note.\*

\* The following is a summary of the more important of the peculiar and characteristic animals of the Palearctic Region. Among the Mammalia are *Talpa* (moles) almost peculiar; *Meles* (badgers) almost peculiar, but entering the Oriental region in China; *Camelus* (camels) confined to the deserts on the southern borders of the region; several peculiar genera or sub-genera of deer, as *Capreolus* in Europe, and *Moschus* in Mongolia; many peculiar Bovidæ, as *Poephagus* (the yak), several peculiar antelopes in N. Africa, Thibet, and Mongolia; *Rupicapra* (the chamois), and *Saiga* (the Tartarian antelope), while *Capra* (sheep and goats), is highly characteristic. Among Rodents there are 4 peculiar genera of Muridæ (rats and mice), 2 of Spalacidæ (mole-rats), while *Myoxus* (dormice), and *Lagomys* (pikas) are almost peculiar.

Among birds, there are 14 peculiar or very characteristic genera of Sylviidæ (warblers), 4 of Panuridæ (reedlings), 1 of Paridæ (tits), 4 of Corvidæ (crows and magpies), 12 of Fringillidæ (finches), 2 of Alaudidæ (larks), 1 of Pteroclidæ (sand-grouse), 4 of Tetraonidæ (grouse and partridges), 5 of Phasianidæ (pheasants), while there are 5 very characteristic genera of wading birds, *Ortygometra* and *Otis* being good examples.

In reptiles, the Palearctic, like all temperate regions, is poor, yet it has many peculiar types. Among these are 2 genera of snakes, *Rhinechis* and *Halsys*; 7 of lizards, *Trigonophis*, *Psammotromus*, *Hyalosaurus*, *Scincus*, *Ophiomorus*, *Megalobolus*, and *Phrynocephalus*; 8 of tailed Batrachians, *Proteus*, *Salamandra*, *Seiranota*, *Chioglossa*, *Hynobius*, *Onychodactylus*, *Geotriton*, and *Sieboldia*; and 8 of tailless Batrachians, *Bombinator*, *Pelobates*, *Dolopus*, *Alytes*, *Pelodytes*, *Discoglossus*, *Laprisa*, and *Latonina*.

Of fresh-water fish there are also about 20 peculiar genera, belonging to the following families, Percidæ (3 genera), Comephoridæ (consisting of the genus *Cumephorus* confined to Lake Baikal), Salmonidæ (3 genera), Cyprinodontidæ (1 genus), and Cyprinidæ (13 genera).

In insects, there are 15 peculiar genera of Diurnal Lepidoptera or butterflies; while among the Coleoptera, the Carabidæ, or ground beetles, are very numerous, no less than 50 genera being peculiar. Other important families of beetles are Buprestidæ, with 9 peculiar genera, and Longicorns, with 50 peculiar genera,

The Ethiopian region, consisting of Africa south of the Tropic of Cancer with Madagascar, is of very small area compared with the Palæarctic region; yet owing to the absence of extreme climates, and the tropical luxuriance of a considerable portion of its surface, it supports a greater number and variety of large animals than any other part of the globe of equal extent. Much of the speciality of the region is, however, due to the rich and isolated fauna of Madagascar, the peculiarities of which may be set aside till we come to discuss the past history of the Ethiopian region.

Considering then, first, the zoological features of tropical and southern Africa alone, we find a number of very peculiar forms of mammalia. Such are the golden moles, the Potamogale, and the elephant-shrews among Insectivora; the hippopotami and the giraffes, among Ungulata; the hyæna-like *Proteles* (Aard-wolf), and *Lycæon* (hyæna-dog), among Carnivora; and the Aard-varks (*Orycteropus*) among Edentata. These are all peculiar, but, among highly characteristic forms are the baboons, and several genera of monkeys and apes; several peculiar lemurs; a great variety of the civet-family (Viverridæ), and of rodents; peculiar genera of swine (*Potamochoerus* and *Phacochoerus*), and a greater abundance and variety of antelopes than are to be found in all the other regions combined. But the Ethiopian region is strikingly distinguished from all others, not only by possessing many peculiar forms, but by the absence of a number of common and widely-distributed groups of mammalia. Such are the bears, which range over the whole northern hemisphere, and as far south as Sumatra in the eastern and Chili in the western hemisphere, yet they are totally wanting in Tropical and South Africa; the deer, which are still more widely distributed, ranging all over North and South America, and over all Asia to Celebes and the Moluccas, yet they are totally absent from the Ethiopian region; goats and sheep, true oxen (*Bos*), and true pigs (*Sus*), are also absent; though as to the last there is some doubt, certain wild pigs having been observed, though rarely, in various parts of tropical Africa, but it is not yet determined whether they are indigenous, or escaped from domestication. The absence of such wide-spread families as the bears and deer is, however, most important, and must be taken into ac-

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many of which are large and important; while such families as Staphylinidæ, Aphodiidæ, Copridæ, Geotrupidæ, Melolonthidæ, Elateridæ, Pimeliidæ, Curculionidæ, and many others, are very abundant.

Land-shells are tolerably abundant, there being about 1250 species, but few if any peculiar genera. *Helix*, *Clausilia*, and *Pupa*, are the genera most abounding in species.

count when we come to consider the geographical changes needed to explain the actual state of the Ethiopian fauna.

The birds are not proportionately so peculiar, yet there are many remarkable forms. Most important are the plantain-eaters, the ground-hornbills, the colies, and the anomalous secretary-bird:—while among characteristic families there are numbers of peculiar genera of flycatchers, shrikes, crows, sun-birds, weaver-birds, starlings, larks, francolins, and the remarkable sub-family of the Guinea-fowls. There are not such striking deficiencies among birds as among mammals, yet there are some of importance. Thus, there are no wrens, creepers, or nuthatches, and none of the wide-spread group comprising the true pheasants and jungle-fowl—a deficiency almost comparable with that of the bears or the deer. Among the lower vertebrates there are 3 peculiar families of snakes and 1 of lizards, as well as 1 of toads, and 3 of fresh-water fishes.\*

\* The following is a summary of the more important groups of animals which characterise the Ethiopian region:—

There are 9 peculiar families of Mammalia (6 confined to the Continent). Potamogalidæ and Chrysocloridæ belonging to the Insectivora, Protelidæ to the Carnivora, Hippopotamidæ and Camelopardalidæ to the Ungulata, and Orycteropodidæ to the Edentata; and 3 to Madagascar,—Chiromyidæ, containing the Aye-aye, Centetidæ, and Cryptoproctidæ. There are also 7 peculiar genera of apes, 3 genera of lemurs in Africa, and 6 in Madagascar, 3 genera of bats, 2 genera of Macroscelididæ or elephant-shrews, 17 peculiar genera of Viverridæ, 2 of Canidæ, 2 of Mustelidæ, 2 of Suidæ, 12 of Bovidæ (all antelopes), 13 of Muridæ, 3 of Spalacidæ, 1 of Dipodidæ, 1 of Sciuridæ, 1 of Octodontidæ, and 2 of Echimyidæ.

Birds are not so strikingly peculiar, there being only 6 families confined to the region. These are Pucridæ, Musophagidæ, Coliuidæ, Leptosomidæ, Iridopodidæ, Serpentiariidæ. The peculiar genera are numerous and interesting; there being 2 of Turdidæ, 10 of Sylviidæ, 5 of Timaliidæ, 1 (*Mesites*) doubtfully belonging to the Cinclidæ, 1 of Sittidæ, 2 of Paridæ, 5 of Pycnonotidæ, 2 of Oriolidæ, 2 of Campephagidæ, 13 of Muscipidæ, 17 of Laniidæ, 3 of Corvidæ, 4 of Nectariniidæ, 1 of Dicaeidae, 3 of Hirundinidæ, 3 of Fringillidæ, 22 of Ploceidæ, 12 of Sturnidæ, 5 of Alaudidæ, 1 of Motacillidæ, 4 of Picidæ, 7 of Megalæmidæ, 3 of Cuculidæ, 3 of Coraciidæ, 1 of Meropidæ, 1 of Trogonidæ, 3 of Alcedinidæ, 3 of Bucerotidæ, 3 of Caprimulgidæ, 5 of Psittacidæ, 4 of Columbidae, 3 of Tetraronidæ, 4 of Phasianidæ (all Guinea-fowls), 1 of Turnicidæ, 1 of Vulturidæ, 11 of Falconidæ, 1 of Strigidæ, and 4 of wading birds.

*Reptiles*.—There are 3 peculiar families of snakes, Rachiodontidæ, Dendraspidæ, and Atractaspidæ; and 1 of lizards, Chamaesauridæ. There are besides, 4 peculiar genera of Colubridæ, 2 of Dendrophidæ, 1 of Dryophidæ, 1 of Dipsadidæ, 5 of Lycodontidæ, 2 of Pythonidæ, 3 of Elapidæ, and 1 of Viperidæ. There are also 15 genera of lizards either peculiar or characteristic, and 4 of tortoises. Of Amphibia there is only one peculiar family, the Dactylethridæ.

Of fresh-water fish there are 3 peculiar families, Mormyridæ, Gymnarchidæ, and Polypteridæ.

*Insects*.—Eleven out of the sixteen families of butterflies are represented in Africa, but none are peculiar; but there are a large number of characteristic or peculiar genera, chiefly belonging to the Acraeidae, Satyridæ, Nymphalidæ, Lycaenidæ, and Pieridæ. Of beetles there are an immense number of peculiar genera, the most remarkable belonging to the Cicindelidæ, Carabidæ, Buprestidæ,

The Oriental region comprises all tropical Asia east of the Indus, with the Malay Islands as far as Java, Borneo, and the Philippines. In its actual land-area it is the smallest region except the Australian; but if we take into account the wide extent of shallow sea connecting Indo-China with the Malay Islands, and which has, doubtless, at no distant epoch, formed an extension of the Asiatic Continent, it will not be much smaller than the Ethiopian region. Here we find all the conditions favourable to the development of a rich and varied fauna. The land is broken up into great peninsulas and extensive islands; lofty mountains and large rivers everywhere intersect it, while along its northern boundary stretches the highest mountain-range upon the globe. Much of this region lies within the equatorial belt, where the equability of temperature and abundance of moisture produce a tropical vegetation of unsurpassed luxuriance. We find here, as might be expected, that the variety and beauty of the birds and insects is somewhat greater than in the Ethiopian region; although, as regards mammalia, the latter is the most prolific, both in genera, species, and individuals.

The families of Mammalia actually peculiar to this region are few in number, and of limited extent. They are,—the Galeopithecidae, or flying lemurs; the Tarsiidae, consisting of the curious little Tarsier, allied to the lemurs; and the Tupaiidae, a remarkable group of squirrel-like Insectivora. There are, however, a considerable number of peculiar genera forming highly characteristic groups of animals—such as the various apes, monkeys, and lemurs—almost all the genera of which are peculiar; a large number of civets and weasels; the beautiful deer-like Chevrotains, often called mouse-deer; and a few peculiar antelopes and rodents. It must be remarked, that we find here none of those deficiencies of wide-spread families which were so conspicuous a feature of the Ethiopian region—the only one worth notice being the dormice (*Myoxidae*), a small family spread over the Palearctic and Ethiopian regions, but not found in the Oriental.

The birds of the Oriental region are exceedingly numerous and varied, there being representatives of about 350 genera of land-birds, of which nearly half are peculiar. Three families are confined to the region—the hill-tits (*Liotrichidae*), the green Bulbuls (*Phyllornithidae*), and the gapers (*Eurylamidae*); while four other families are more abundant here than elsewhere, and are so widely

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Cetoniidae, and Longicorns. *Mantidora* (Cicindelidae), and *Goliathus* (Cetoniidae), are pre-eminently large and remarkable forms.

Terrestrial mollusca are not very numerous, but the genus *Achatis* is very characteristic, containing some of the largest known land-shells.



distributed throughout the region as to be especially characteristic of it. These are—the elegant pittas, or ground-thrushes (*Pittidæ*), the trogons (*Trogonidæ*), the hornbills (*Bucerotidæ*), and the pheasants (*Phasianidæ*); represented by such magnificent birds as the fire-backed pheasants, the ocellated pheasants, the Argus-pheasant, the pea-fowl, and the jungle-fowl.

Reptiles are very abundant, but only 3 small families of snakes are peculiar. There are also 3 peculiar families of fresh-water fishes.\*

Having thus briefly sketched the main features of the existing faunas of Europe, Asia, and Africa, it will be well, while their resemblances and differences are fresh in our memory, to consider what evidence we have of the changes which may have resulted in their present condition. All these countries are so intimately connected, that their past history is greatly elucidated by the knowledge we possess of the Tertiary fauna of Europe and India; and we shall find that when we once obtain clear ideas of their mutual

\* The following is a summary of the chief groups of animals which characterize the Oriental region:—

Besides the peculiar families of Mammalia noticed above, there are a large number of peculiar genera, viz., 6 of apes and monkeys, and 2 of lemurs, 11 of bats, 1 of Erinaceidæ, 12 of Viverridæ, 1 of Canidæ, 5 of Mustelidæ, 2 of Ursidæ, 1 of Delphinidæ, 1 of Tragulidæ, 1 of Cervidæ, 4 of Bovidæ, 3 of Muridæ, 1 of Sciuridæ, and 1 of Hystricidæ.

The following families of birds contain peculiar genera, in addition to the three peculiar families noticed above; 3 of Turdidæ, 9 of Sylviidæ, 21 of Timaliidæ, 2 of Panuridæ, 2 of Cinclidæ, 3 of Troglodytidæ, 2 of Certhiidæ, 1 of Sittidæ, 4 of Paridæ, 4 of Pycnonotidæ, 1 of Oriolidæ, 3 of Campephagidæ, 4 of Dieruridæ, 12 of Muscicapidæ, 2 of Laniidæ, 7 of Corvidæ, 3 of Nectariniidæ, 1 of Fringillidæ, 6 of Sturnidæ, 2 of Motacillidæ, 2 of Pittidæ, 13 of Picidæ, 4 of Megalomyidæ, 11 of Cuculidæ, 1 of Meropidæ, 1 of Trogonidæ, 2 of Alcedinidæ, 7 of Bucerotidæ, 1 of Psittacidæ, 1 of Columbidae, 2 of Tetraonidæ, 6 of Phasianidæ, 2 of Falconidæ, 3 of Strigidæ, and 1 of Parridæ.

*Reptiles*.—There are only 3 peculiar families of snakes; Xenopeltidæ, Uropeltidæ, and Acrochordidæ; but the following are abundant and characteristic, Oligodontidæ, Homalopsidæ, Dendrophidæ, Dryophidæ, Dipsadidæ, Lycodontidæ, Pythonidæ, Elapidæ, and Crotalidæ. There are no peculiar families of lizards, but the Varanidæ, Scincidæ, Geckotidæ, and Agamidæ, are wide-spread and characteristic groups. Of Amphibia the most characteristic families are Engystomidæ, Polypedatidæ, and Ranidæ.

Fresh-water fishes are abundant, the Nandidæ, Labyrinthici, Ophiocephalidæ, Siluridæ, and Cyprinidæ being characteristic families, and the last especially abundant.

Insects are very numerous and varied. The most remarkable butterflies belong to the Danaidæ, Nymphalidæ, Lyceenidæ, Pieridæ, and Papilionidæ, the genera *Euplexa*, *Hestia*, *Cethosia*, *Iphiax*, *Teinopalpus*, and *Ornithoptera*, being the most remarkable.

Beetles abound: *Mormolyce* (Carabidæ), *Odontolabis* and *Cladognathus* (Lucanidæ), *Catoxantha* (Buprestidæ), *Batocera* (Lamiidæ), and *Chalcosoma* (Scarabæidæ), are the largest and most remarkable.

Land-shells are exceptionally abundant in the Philippine Islands.

relations, we shall be in a better position to study the history of the remaining continents.

Let us therefore go back to the Miocene or Middle Tertiary epoch, and see what was then the distribution of the higher animals in these countries. Extensive deposits, rich in animal remains of Miocene age, occur in France, Switzerland, Germany, Hungary, Greece; and also in North-Western India at the Siwalik Hills, in Central India in the Nerbudda Valley, in Burmah, and in North China; and over the whole of this immense area we find a general agreement in the fossil mammalia, indicating that this great continent was probably then, as now, one continuous land. The next important geographical fact that meets us, is, that many of the largest and most characteristic animals, now confined to the tropics of the Oriental and Ethiopian regions, were then abundant over much of the Palæarctic region. Elephants, rhinoceroses, tapirs, horses, giraffes, antelopes, hyænas, lions, as well as numerous apes and monkeys, ranged over all Central Europe, and were often represented by a greater variety of species than exist now. Antelopes were abundant in Greece, and several of these appear to have been the ancestors of those now living in Africa; while two species of giraffes also inhabited Greece and North-West India. Equally suggestive is the occurrence in Europe of such birds as trogons and jungle-fowl characteristic of tropical Asia, along with parrots and plaitain-eaters allied to forms now living in West Africa.

Let us now inquire what information Geology affords us of changes in land and sea at this period. From the prevalence of early Tertiary deposits over the Sahara and over parts of Arabia, Persia, and Northern India, geologists are of opinion that a continuous sea or strait extended from the Bay of Bengal to the Atlantic Ocean, thus cutting off the Peninsula of India with Ceylon, as well as all tropical and South Africa from the great northern continent.\* At the same time, and down to a comparatively recent period, it is almost certain that Northern Africa was united to Spain and to Italy, while Asia Minor was united to Greece, thus reducing the Mediterranean to the condition of two inland seas. We also know that the north-western Himalayas and some of the high lands of Central Asia were at such a moderate elevation as to enjoy a climate as mild as that which prevailed

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\* Mr. Searles V. Wood, "On the Form and Distribution of the Land-tracts during the Secondary and Tertiary Periods respectively," *Philosophical Magazine*, 1862.

in Central Europe during the Miocene epoch,\* and was therefore perhaps equally productive in animal and vegetable life.

We have, therefore, good evidence that the great Euro-Asiatic continent of Miocene times exhibited in its fauna a combination of all the main features which now characterise the Palæarctic, Oriental, and Ethiopian regions; while tropical Africa, and such other tropical lands as were then, like the peninsula of India, detached and isolated from the continent, possessed a much more limited fauna, consisting for the most part of animals of a lower type, and which were more characteristic of Eocene or Secondary times. Many of these have no doubt become extinct, but they are probably represented by the remarkable and isolated lemurs of West Africa and Southern Asia, by the peculiar Insectivora of South Africa and Malaya, and by the Edentata of Africa and India. These are all low and ancient types, which were represented in Europe in the Eocene and early Miocene periods, at a time when the more highly specialised horses, giraffes, antelopes, deer, buffaloes, hippopotami, elephants, and anthropoid apes had not come into existence. And if these large herbivorous animals were all wanting in tropical Africa in Miocene times, we may be quite sure that the large felines and other carnivora which prey upon them were absent also. Lions, leopards, and hyænas can only exist where antelopes, deer, or some similar creatures abound; while smaller forms allied to the weasels and civets would be adapted to a country where small rodents or defenceless Edentata were the chief vegetable-feeding mammalia.

If this view is correct (and it is supported by a considerable amount of evidence which it is not possible here to adduce), all the great mammalia which now seem so specially characteristic of Africa,—the lions, leopards, and hyænas,—the zebras, giraffes, buffaloes and antelopes,—the elephants, rhinoceroses and hippopotami,—and perhaps even the numerous monkeys, baboons, and anthropoid apes,—are every one of them comparatively recent immigrants, who took possession of the country as soon as an elevation of the old Eocene and Miocene sea-bed afforded a passage from the southern borders of the Palæarctic region. This event probably occurred about the middle of the Miocene period, and it must have effected a vast change in the fauna of Africa. A number of the smaller and more defenceless of the ancient inhabitants must have been soon exterminated, as surely as our

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\* This part of the Himalayas was elevated during the Eocene period, and remains of a fossil *Rhinoceros* have been found at 16,000 feet elevation in Thibet.

introduced pigs, dogs, and goats, exterminate so many of the inhabitants of oceanic islands; while the new comers, finding a country of immense extent, with a tropical climate and not too much encumbered with forest vegetation, spread rapidly over it, and thenceforth greatly multiplying became more or less modified in accordance with the new conditions. We shall find that this theory not only accounts for the chief specialities, but also explains many of the remarkable deficiencies of the Ethiopian fauna. Thus, bears and deer are absent, because they are comparatively late developments, and were either unknown or rare in Europe till late Miocene or Pliocene times; while, on the other hand, the immense area of open tropical country in Africa has favoured the preservation of numerous types of large mammalia which have perished in the deteriorated climate and diminished area of Europe.

Our knowledge of the geology of Africa is not sufficiently detailed to enable us to determine its earlier history with any approach to accuracy. It is clear, however, that Madagascar was once united with the southern portion of the continent, but it is no less clear that its separation took place before the great irruption of large animals just described; for all these are wanting, while lemurs, insectivora, and civets abound, just the low types which were once the only inhabitants of the main land. It is worthy of note, that south-temperate Africa still exhibits a remarkable assemblage of peculiar forms of mammalia, birds, and insects,—the two former groups mostly of a low grade of organisation; and these, taken in connection with the wonderfully rich and highly specialised flora of the Cape of Good Hope, point to the former existence of an extensive south temperate land in which so many peculiar types could have been developed. Whether this land was separated or not from Equatorial Africa, or formed with it one great southern continent, there is no sufficient evidence to determine.

Turning now to Tropical Asia, we find a somewhat analogous series of events, but on a smaller scale and with less strongly-marked results. At the time when tropical and South Africa were so completely cut off from the great northern continent, the peninsula of India with Ceylon was also isolated, and it seems probable that their union with the continent took place at a somewhat later period. The ancient fauna of this south-Asiatic island may be represented by the *Slow Loris*, a peculiar type of lemur, some peculiar rats (*Muridæ*), and perhaps by the *Edentate* scaly ant-eater; by its *Uropeltidæ*, a peculiar family of snakes, and by many peculiar genera of snakes and lizards, and a few peculiar amphibia. On the other hand, we must look upon the monkeys,

the large carnivora, the deer, the antelopes, the wild pigs, and the elephants, as having overrun the country from the north, and their entrance must, no doubt, have led to the extermination of many of the lower types.

But there is another remarkable series of changes which have undoubtedly taken place in Eastern Asia in Tertiary times. There is such a close affinity between the animals of the Sunda Islands and those of the Malay Peninsula and Siam, and between those of Japan and Northern Asia, that there can be little doubt that these islands once formed a southern and eastern extension of the Asiatic continent. The Philippines and Celebes perhaps also formed a part of this continent, but if so, the peculiarity and poverty of their mammalian fauna shows that they must have been separated at a much earlier period.\* The other islands probably remained united to the continent till the Pliocene period. The result is seen in the similarity of the flora of Japan to that which prevailed in Europe in Miocene times; while in the larger Malay Islands we find, along with a rich flora developed under long-continued equatorial conditions of uniform heat and moisture, a remnant of the fauna which accompanied it, of which the Malay tapir, the anthropoid apes, the tupaias, the galeopithecii or flying lemurs, and the sun-bears, may be representatives.

There is another very curious set of relations worthy of our notice, because they imply some former communication between the Malay Islands, on the one hand, and South India with Ceylon, on the other. We find, for example, such typical Malay forms as the Tupaia, some Malay genera of cuckoos and Timaliidae, some Malayan snakes and amphibia, the remarkable genus *Hestia* among butterflies, and no less than seven genera of beetles of purely Malay type,† all occurring either in Ceylon only or in the adjacent parts of the peninsula, but in no other part of India. These cases are so numerous and so important, that they compel us to assume some special geographical change to account for them. But directly between Ceylon and Malaya there intervenes an ocean-depth of more than 15,000 feet, and besides the improbability of so great a subsidence, of which we have no direct evidence, a land communication of this kind would almost certainly have left more general proofs of its existence in the faunas of the two countries. But, when in Miocene times a sub-tropical climate extended into Central Europe, it seems probable that the equatorial belt of vege-

\* For a full account of the evidence and conclusions as to these islands, see the Author's 'Geographical Distribution of Animals,' vol. i., pp. 345, 359, 426, 436.

† For details see 'Geographical Distribution of Animals,' vol. i., p. 327.

tation, accompanied by its peculiar fauna, would have been wider than at present, extending perhaps as far as Burma. If then the shallow northern part of the Bay of Bengal had been temporarily elevated during the late Miocene or Pliocene epochs, a few Malayan types may have migrated to the Peninsula of India, and have been preserved only in Ceylon and the Nilgherries, where the climate still retains somewhat of its equatorial character, and the struggle for existence is somewhat less severe than in the northern parts of the region, so much more productive in varied forms of life.

There are also indications, hardly less clear, of some communication between India and Malaya on the one hand, and Madagascar on the other; but as these indications depend chiefly on resemblances in the birds and insects, they do not imply that any land-connection has occurred. If, as seems probable, the Laccadive and Maldivé Islands are the remains of a large island, or indicate a western extension of India, while the Seychelles, with the shallow banks to the south-east and the Chagos group, are the remains of other extensive lands in the Indian Ocean, we should have a sufficient approximation of these outlying portions of the two continents to allow a certain amount of interchange of such winged groups as birds and insects, while preventing any intermixture of the mammalia.

The presence of some African types (and even some African species) of mammals in Hindostan appears to be due to more recent changes, and may perhaps be explained by a temporary elevation of the comparatively shallow borders of the Arabian Sea, admitting of a land-passage from North-East Africa to Western India.

There remains to be considered the supposed indications of a very ancient communication between Africa, Madagascar, Ceylon, Malaya, and Celebes, furnished by the occurrence over this extensive area of isolated forms of the lemur tribe. The anomalous range of this group of animals has been thought to require for its explanation the existence of an ancient southern continent, which has been called Lemuria; but a consideration of all the facts does not seem to warrant such a theory. Had such a continent ever existed, we are sure that it must have disappeared long before the Miocene period, or it would assuredly have left more numerous and widespread indications of the former connections of these distant lands than actually exist. And when we go back to the Eocene period, we are met by the interesting discovery of an undoubtedly Lemurine animal in France, and what are supposed to be allied forms in North America. This proof of the great antiquity and wide range

of lemurs is quite in accordance with their low grade of development; while the extreme isolation and specialisation of many of the existing types (of which the Aye-aye of Madagascar is a wonderful example), and their scattered distribution over a wide tropical area, all suggest the idea that these are but the remnants of a once extensive and widely-distributed group of animals, which, in competition with higher forms, have preserved themselves either by their solitary and nocturnal habits, or by restriction to ancient islands like Madagascar, where the struggle for existence has been less severe. Lemuria, therefore, may be discarded as one of those temporary hypotheses which are useful for drawing attention to a group of anomalous facts, but which fuller knowledge shows to be unnecessary.

We will now pass across the Atlantic to the Western Hemisphere, and consider first the Nearctic region, or temperate North America, whose present and past zoological relations with the rest of the world are of exceeding interest.

If we omit such animals as the musk-sheep (*Oribos*), which is purely Arctic, and the peccaries (*Dicotyles*), which are hardly less distinctly tropical, the land-mammalia of North America are not very numerous; and they can be for the most part divided into two groups, the one allied to the Palearctic, and the other to the Neotropical fauna. The bears, the wolves, the cats, the bison, sheep and antelope, the hares, the marmots, and the pikas, resemble Palearctic forms; while the racoons, skunks, opossum, and vesper-mice are now more peculiarly Neotropical. There are also many genera which are altogether peculiar and characteristic of the region, as the prong-horn antelope (*Antilocapra*), the jumping-mouse (*Jaculus*), five genera of pouched rats (*Sacomysidae*), the prairie dogs (*Cynomys*), the tree porcupines (*Erethizon*), and some others.

Birds present the same mixture of the two types, but the wild turkeys (*Meleagris*), the passenger pigeon (*Ectopistes*), the crested quails (*Lophortyx*, &c.), the ruffed grouse (*Cupidonia*), and some other groups of less importance, are peculiar; while the family of the wood warblers (*Mniotiltidae*) is so largely developed that it may claim to be more characteristic of North than of South America.

Reptiles and Amphibia present a number of peculiar types; while no less than five peculiar families of fresh-water fishes would alone serve to mark out this as distinct from every other part of the world.

Considering the evident affinity between the Nearctic and Palæ-

arctic regions, there are here some curious deficiencies of groups which are common and widely spread in the latter. Thus hedgehogs, wild horses and asses, swine, true oxen, goats, dormice, and true mice are absent; while sheep and antelopes are only represented by solitary species in the Rocky Mountains. Among birds, too, we have such striking deficiencies as the extensive families of flycatchers, starlings, and pheasants.\*

Turning now to the Neotropical region, comprising all South America and the tropical parts of the northern continent, we find that the Old World types have still further diminished, while a number of new and altogether peculiar forms have taken their place. Insectivora have wholly disappeared, with the exception of one anomalous form in the greater Antilles; bears are represented by one Chilian species; swine are replaced by peccaries; the great Bovine family are entirely unknown; the camel tribe are confined to the Southern Andes and the south temperate plains; deer are not numerous; and all the varied Ungulata of the Old World are

\* The following is a summary of the most important groups of animals characteristic of the Nearctic region:—

There are only 2 peculiar families of mammalia—*Saccomyidae*, or pouched rats, and *Haplodontidae*, a peculiar squirrel-like animal of the west coast. The peculiar genera belong to the following families:—2 genera of bats (*Vespertilionidae*), 3 of moles (*Talpidae*), 2 of *Mustelidae*, 3 of *Bovidae*, 3 of *Muridae*, 1 of *Dipodidae*, 1 of *Sciuridae*, and 1 of *Cercolabidae*.

There is but one wholly peculiar family of birds—*Chamaeidae*—containing a single Californian species; but the peculiar or highly characteristic genera are numerous, as the following enumeration will show:—2 genera of *Turdidae*, 1 of *Sylviidae*, 2 of *Troglodytidae*, 2 of *Paridae*, 2 of *Corvidae*, 6 of *Mniotiltidae*, 1 of *Ampelidae*, 2 of *Icteridae*, 13 of *Fringillidae*, 1 of *Motacillidae*, 2 of *Picidae*, 2 of *Trochilidae*, 1 of *Columbidae*, 5 of *Tetraonidae*, 1 of *Phasianidae* (the wild turkey), 1 of *Strigidae*, and 1 of *Scelopacidae*.

Reptiles, considering the climate, are well represented. There are 11 peculiar genera of snakes—4 *Colubridae*, 2 *Homalopsidae*, 1 *Pythonidae*, and 4 *Crotalidae*. Of lizards, 1 (*Chirotes*) forms a peculiar family, and there are 7 other peculiar genera—1 *Zonuridae*, and the remainder *Iguanidae*.

Amphibia are abundant and remarkable, there being two peculiar families—*Sirenidae* and *Amphiumidae*, 1 peculiar genus of *Proteidae*, 9 of *Salamandridae*, and 3 peculiar genera of tailless batrachians.

Fresh-water fishes are very numerous in the Nearctic region, and there are an unusual number of peculiar forms. There are at least five peculiar families—*Aphredoderidae*, *Heteropygii* or *Amblyopsidae*, *Percopsidae*, *Hyodontidae*, and *Amiidae*—while *Lepidosteidae* is almost peculiar, and two groups—*Etheostomidae* and *Ichthulidae*—have recently been separated from the perches as distinct families. There are in all about 120 genera of fresh-water fishes in the region, a considerable number of which are peculiar to it.

*Insects*.—The butterflies of the Nearctic region present little peculiarity, almost all being representatives of either Palearctic or Neotropical forms. The beetles are more interesting. There are 2 peculiar genera of *Cicindelidae*, and a large number of *Carabidae* and *Longicorns*.

The land-shells are not very remarkable; but the fresh-water forms are, as might be expected, exceedingly numerous. The generic types are, however, as in all fresh-water productions, widely spread over the globe.



represented only by a few species of tapirs. These great gaps are, however, to some extent filled up by a variety of interesting and peculiar types. Two families of monkeys (*Cebidæ* and *Hapalidæ*) differ in many points of structure from all the *Quadrumana* of the eastern hemisphere. There is a peculiar family of bats—the *vampyres*; many peculiar weasels and *Procyonidæ*; a host of peculiar rodents, comprising five distinct families, among which are the largest living forms of the order; and a great number of *Edentata*, comprising the families of the sloths, armadillos, and ant-eaters; and lastly, a considerable number of the marsupial family of opossums. As compared with the Old World, we find here a great abundance and variety of the lower types, with a corresponding scarcity of such higher forms as characterise the tropics of Africa and Asia.

In birds we meet with corresponding phenomena. The most abundant and characteristic families of the Old World tropics are replaced here by a series of families of a lower grade of organisation, among which are such remarkable groups as the chattering (*Cotingidæ*), the manakins (*Pipridæ*), the ant-thrushes (*Formicariidæ*), the toucans (*Rhamphastidæ*), the motmots (*Momotidæ*), and the humming-birds (*Trochilidæ*), the last perhaps the most remarkable and beautiful of all developments of the bird-type. Parrots are numerous, but these, too, are mostly of peculiar families; while pheasants and grouse are replaced by curassows and tinamous, and there are an unusual number of remarkable and isolated forms of waders.

Reptiles, amphibia, fresh-water fishes, insects, and land-shells, are all equally peculiar and abundant, so that South America presents, on the whole, an assemblage of curious and beautiful natural objects, unsurpassed—perhaps even unequalled—in any other part of the globe.\*

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\* The following is a summary of the peculiar families and most characteristic types of the Neotropical region:—

The following 8 families of *Mammalia* are peculiar to this region. Of monkeys 2 families, *Cebidæ* and *Hapalidæ*; of bats, 1 family, *Phyllostomidæ* (except one species in California); of rodents, 2 families, *Chinchillidæ* and *Caviidæ*; of *Edentata*, 3 families; *Bradypodidæ*, *Dasypodidæ*, and *Myrmecophagidæ*. Peculiar genera in other families are very numerous; of bats (*Vespertilionidæ* and *Noctilionidæ*), there are 10 peculiar genera; of *Insectivora*, 1; of *Canidæ*, 5; of *Mustelidæ*, 3; of *Procyonidæ*, 2; of *Ursidæ*, 1; of *Otariidæ*, 1; of *Delphinidæ*, 1; of *Tapiridæ*, 1; of *Suidæ*, 1; of *Camelidæ*, 1; of *Muridæ*, 6; of *Saccomyidæ*, 1; of *Octodontidæ*, 6; of *Echimyidæ*, 8; of *Cercolabidæ*, 2; and of *Didelphyidæ*, 2.

Of birds there are no less than 24 peculiar families, a larger number than is found in any other region. These are 8 of *Passeres*—*Cærebidæ*, *Oxyrhamphidæ*, *Pipridæ*, *Cotingidæ*, *Phytotomidæ*, *Dendrocolaptidæ*, *Formicariidæ*, and *Pterotochidæ*; 6 of *Picariæ*—*Rhamphastidæ*, *Bucconidæ*, *Galbulidæ*, *Todidæ*, *Momotidæ*,

We will now proceed to examine what is known of the past history of the two American Continents, and endeavour to determine what have been their former relations to each other and to the Old World, and how their existing zoological and geographical features have been brought about. And first let us see what knowledge we

and *Statornithidæ*; 2 of *Gallinæ*—*Cracidæ* and *Tinamidæ*; 1 of *Opisthocomi*—*Opisthocomidæ*; and 7 of *Grallæ*—*Chionididæ*, *Thinocoridæ*, *Cariamidæ*, *Aramidæ*, *Psophiidæ*, *Eurypygidæ*, and *Palamedeidæ*. Almost peculiar are *Tanagridæ*, *Tyrannidæ*, *Trochilidæ*, and *Conuridæ*, of which but a few species are *Neartic*. The peculiar genera (in addition to those in the peculiar families) are also very numerous; *Turdidæ* has 8, *Sylviidæ* 1, *Troglodytidæ* 7, *Corvidæ* 3, *Mniotiltidæ* 6, *Vireonidæ* 6, *Ampelidæ* 2, *Hirundinidæ* 1, *Icteridæ* 15, *Tanagridæ* 42, *Fringilidæ* 30, *Tyrannidæ* 65, *Picidæ* 6, *Megalamidæ* 2, *Cuculidæ* 10, *Trogonidæ* 5, *Caprimulgidæ* 9, *Cypselidæ* 4, *Trochilidæ* 115, *Conuridæ* 6, *Psittacidæ* 7, *Columbidæ* 9, *Tetraonidæ* 3, *Vulturidæ* 2, *Falconidæ* 19, *Strigidæ* 7, *Rallidæ* 1, *Charadriidæ* 3, *Ardeidæ* 2, *Anatidæ* 3, and *Struthionidæ* 1.

The *Neotropical* reptiles are also very numerous and peculiar. Of snakes there are, however, no peculiar families, but the *Scytalidæ* are nearly so. Sixteen families occur in the region,—*Colubridæ*, *Amblycephalidæ* and *Pythonidæ* being richest in peculiar forms. There are 25 peculiar or characteristic genera, the most important being, *Dromicus* (*Colubridæ*), *Boa*, *Epicrates*, and *Ungalia* (*Pythonidæ*), *Elaps* (*Elapidæ*), and *Craspedocephalus* (*Crotalidæ*).

Of lizards there are 15 families in the region, 5 of these being peculiar, while 4 others extend only to North America. The peculiar families are *Helodermidæ*, *Anadiadæ*, *Chirocolidæ*, *Iphisidæ*, and *Cercosauridæ*; those which extend also to North America, but not to any other continent, are, *Chirotidæ*, *Chalcidæ*, *Teiidæ*, and *Iguanidæ*. There are more than 50 peculiar or very characteristic genera of lizards in the region, about 40 of which belong to the two families *Teiidæ* and *Iguanidæ*. The most important of these genera are, *Ameiva* (*Teiidæ*), *Celestus* and *Diploglossus* (*Scincidæ*), *Sphaerodactylus*, *Hiolemus*, and *Proctotetus* (*Iguanidæ*). The three extensive Old World families, *Varanidæ*, *Lacertidæ*, and *Agamidæ*, are absent from the whole American continent.

In the order *Crocodylia*, America has the peculiar family of the alligators (*Alligatoridæ*).

In the order *Chelonia* or tortoises, there are no peculiar families, but 6 peculiar genera,—*Dermatemys* and *Staurotypus* (*Testudinidæ*), *Peltecephalus*, *Podocnemys*, *Hydromedusa*, and *Chelys* (*Chelydridæ*).

Of *Amphibia* there are 4 peculiar families, *Rhinophrynidæ*, *Hylaplesidæ*, *Plectromantidæ*, and *Pipidæ*; but these are all small, the most important families being *Ranidæ* (11 genera), *Polypedatidæ* (7 genera), *Hylidæ* (8 genera), and *Engystomidæ* (5 genera), almost all of the *Neotropical* genera being peculiar.

Fresh-water fishes are exceedingly abundant, there being 3 peculiar families and about 120 peculiar genera. The peculiar families are *Polycentridæ*, *Gymnotidæ* (which contains the electric eel), and *Trygonidæ*, a family of rays which are usually marine but in South America are found in the rivers of the interior.

Insects are too numerous and varied to be enumerated. Of butterflies there are 3 peculiar families—*Brassolidæ*, *Heliconidæ*, and *Eurygonidæ*—while *Erycinidæ* only extends into the *Neartic* region; and there are about 200 peculiar genera, or nearly as many as in all the rest of the world.

*Coleoptera* are almost equally rich. There are 10 peculiar genera of *Cicindelidæ*, 100 of *Carabidæ*, 12 of *Cetoniidæ*, 18 of *Buprestidæ*, and nearly 500 of *Longicorns*—numbers which sufficiently show the high degree of speciality of the insect fauna.

Land-shells are less remarkable, except in the *Antilles*, where there are more genera and species than on the continent. There are about 20 peculiar genera in the region.

possess of the past relations of North America with the Eastern Continents.

If we go back to that recent period termed the Post-Pliocene—corresponding nearly to the Post-Glacial period and to that of pre-historic man in Europe—we find at once a nearer approximation than now exists between the Nearctic and Palearctic faunas. North America then possessed several large cats, six distinct species of the horse family, a camel, two bisons, and four species of elephants and mastodons. A little earlier, in the Pliocene period (although fossil remains of this age are scanty), we have in addition the genus *Rhinoceros*, several distinct camels, some new forms of ruminants, and an Old-World form of porcupine. Further back, in the Miocene period, we find a Lemuroid animal, numerous insectivora, a host of carnivora, chiefly feline and canine, a variety of equine and tapirine forms, rhinoceroses, camels, deer, and an extensive extinct family—the Oreodontidæ—allied to deer, camels and swine. There are, however, no elephants. In the still earlier Eocene period most of the animals were peculiar, and unlike anything now living, but some were identical with European types of the same age, as *Lophotherium* and the family Anchitheridæ.

These facts compel us to believe, that at distinct epochs during the Tertiary period, the interchange of large mammalia between North America and the Old World has been far more easy than it is now. In the Post-Pliocene period, for example, the horses, elephants and camels of North America and Europe were so closely allied, that their common ancestors must have passed from one continent to the other,—just as we feel assured that the common ancestors of the American and European bison, elk, and beaver must have so migrated. We have further evidence in the curious fact that certain groups appear to come into existence in the one continent much later than in the other. Thus cats, deer, mastodons, true horses, porcupines, and beavers, existed in Europe long before they appeared in America; and as the theory of evolution does not admit the independent development of the same group in two disconnected regions to be possible, we are forced to conclude that these animals have migrated from one continent to the other. Camels, and perhaps ancestral horses, on the other hand, were more abundant and more ancient in America, and may have migrated thence into Northern Asia.

There are two probable routes for such migrations. From Norway to Greenland by way of Iceland and across Baffin Bay to Arctic America, there is everywhere a comparatively shallow sea, and it is not improbable that during the Miocene period, or subsequently, a

land communication may have existed here. On the other side of the continent, at Behring Straits, the probability is greater. For here we have a considerable extent of far shallower sea, which a very slight elevation would convert into a broad isthmus connecting North America and North-East Asia. It is true that elephants, horses, deer, and camels would, under existing climatal conditions, hardly range as far north as Greenland and Alaska; but we must remember that most mysterious yet indisputable fact of the luxuriant vegetation, including even magnolias and other large-leaved evergreens, which flourished in these latitudes during the Miocene period; so that we have all the conditions of favourable climate and abundant food, which would render such interchange of the animals of the two continents not only possible but inevitable, whenever a land communication was effected; and there is reason to believe that this favourable condition of things continued in a diminished degree during a portion of the succeeding Pliocene period.

We must not forget, however, that the faunas of the two continents were always to a great extent distinct and contrasted—such important Old-World groups as the civets, hyænas, giraffes and hippopotami, never passing to America, while the extinct *Oreodontidæ*, *Brontotheridæ*, and many others are equally unknown in the Old World. This renders it probable that the communication, even in the north, was never of long continuance; while it wholly negatives the theory of an Atlantis bridging over the Atlantic ocean in the Temperate Zone, at any time during the whole Tertiary period.

But the past history of the North-American fauna is complicated by another set of migrations from South America, which, like those from the Old World, appear to have occurred at distant intervals, and to have continued for limited periods. In the Post-Pliocene epoch, along with elephants and horses from Europe or Asia, we find a host of huge sloths and other Edentata, as well as llamas, capybaras, tapirs, and peccaries, all characteristic of South America. Some of these were identical with living species, while others are closely allied to those found fossil in Brazilian caves and other deposits of about the same age, while nothing like them inhabited the Old World at the same period. We are therefore quite sure that they came from some part of the Neotropical region; but the singular fact is, that in the preceding Pliocene epoch none of them are found in North America. We conclude, therefore, that their migration took place at the end of the Pliocene or beginning of the Post-Pliocene epoch, owing to some specially favourable conditions,

but that they rapidly disappeared, having left no survivors. We must, however, study the past history of South America in order to ascertain how far it has been isolated from or connected with the northern continent.

Abundant remains of the Post-Pliocene epoch from Brazilian caves show us that the fauna of South America which immediately preceded that now existing, had the same general characteristics, but was much richer in large mammalia and probably in many other forms of life. Edentata formed the most prominent feature; but instead of the existing sloths, armadillos and ant-eaters, there were an immense variety of these animals, some of living genera, others altogether different, and many of them of enormous size. There were armadillos as large as the rhinoceros, while the megatherium and several other genera of extinct sloths were of elephantine bulk. The peculiar families of South American rodents—cavies, spiny-rats, and chinchillas—were represented by other species and genera, some of large size; and the same may be said of the monkeys, bats, and carnivora. Among Ungulata, however, we find, in addition to the living tapirs, llamas, peccaries and deer, several species of horse and antelope as well as a mastodon, all three forms due probably to recent immigration from the northern continent.

Further south, in Bolivia, the Pampas, and Patagonia, we also find abundant fossil remains, probably a little older than the cave-fauna of Brazil, and usually referred to the newer part of the Pliocene period. The same families of rodents and Edentata are here abundant, many of the genera being the same, but several new ones also appearing. There are also horses, peccaries, a mastodon, llamas, and deer; but besides these there are a number of altogether peculiar forms, such as the *Macrauchenia*, allied to the Tapir and Palæotherium; the *Homalodontotherium*, allied to the Miocene *Hyracodon* of North America; and the Toxodontidæ, a group of very large animals having affinities to Ungulates, rodents, Edentata and Sirenia, and therefore probably the representative of a very ancient type.

Here then we meet with a mixture of highly-developed and recent with low and ancient types, but the latter largely predominate; and the most probable explanation seems to be that the same concurrence of favourable conditions which allowed the megatherium and megalonyx to enter North America, also led to an immigration of horses, deer, mastodons, and many of the Felidæ into South America. These inter-migrations appear to have taken place at several remote intervals, the northern and southern continents being for the most part quite separated, and each developing its own

peculiar forms of life. This view is supported by the curious fact of a large number of marine fishes of the two sides of Central America being absolutely identical,—implying a recent union of the two oceans and separation of the continents—while the mollusca of the Pacific coast of America bear so close a relation to those of the Caribbean Sea and the Atlantic coasts, as to indicate a somewhat more remote but longer continued sea-passage. The straits connecting the two oceans were probably situated in Nicaragua and to the south of Panama, leaving the highlands of Mexico and Guatemala united to North America.

Around the Gulf of Mexico and the Caribbean Sea there is a wide belt of rather shallow water, and during the alternate elevations and subsidences to which this region has been subjected, the newly-raised land would afford a route for the passage of immigrants between North and South America. The great depression of the ocean, believed to have occurred during the Glacial period (caused by the locking-up of the water in the two polar masses of ice), may perhaps have afforded the opportunity for those latest immigrations which gave so striking a character to the North American fauna in Post-Pliocene times.

Among the changes which South America itself has undergone, perhaps the most important has been its separation into a group of large islands. Such a change is clearly indicated by the immense area and low elevation of the great alluvial plains of the Orinoko, Amazon, and La Plata, as well as by certain features in the distribution of the existing Neotropical fauna. A subsidence of less than 2000 feet would convert the highlands of Guiana and Brazil into islands separated by a shallow strait from the chain of the Andes. When this occurred, the balance of land was probably restored by an elevation of the extensive submerged banks on the east coast of South America, which in South Brazil and Patagonia are several hundred miles wide, embracing the Falkland Islands, and reaching far to the south of Cape Horn.

Looking then at the whole of the evidence at our command, we seem justified in concluding that the past histories of North and South America have been different, and in some respects strongly contrasted. North America was evidently in very early times so far connected with Europe and Asia as to interchange with those continents the higher types of animal life as they were successively developed in either hemisphere. These more perfectly organised beings rapidly gained the ascendancy, and led to the extinction of most of the lower forms which had preceded them. The Nearctic

has thus run a course parallel to that of the Palearctic region, although its fauna is, and perhaps always has been, less diversified and more subject to incursions of lower types from adjacent lands in the southern hemisphere.

South America, on the other hand, has had a history in many respects parallel to that of Africa. Both have long existed either as continents or groups of large islands in the southern hemisphere, and for the most part completely separated from the northern continents; and each, accordingly, developed its peculiar types from those ancestral and lowly-organised forms which first entered it. South America, however, seems to have had a larger area and more favourable conditions, and it remained almost completely isolated till a later period. It was therefore able to develop a more varied and extensive fauna of its own peculiar types, and its union with the northern continent has been so recent, and is even now maintained by so narrow an isthmus, that it has never been overrun with the more perfect mammalia to anything like the extent that has occurred in Africa. South America, therefore, almost as completely as Australia, has preserved for us examples of a number of low and early types of mammalian life, which, had not the entire country been isolated from the northern continent during middle and late Tertiary times, would long since have become extinct.

There only remains for us now to consider the relation of the island-continent of Australia to Asia and South America, with both which countries it has a certain amount of zoological connection.

Australia, including New Guinea (which has in recent times been united with it), differs from all the other continents by the extreme uniformity and lowly organisation of its mammalia, which almost all belong to one of the lowest orders—the marsupials. Monkeys, carnivora, insectivora, and the great and almost ubiquitous class of hoofed animals, are all alike wanting; the only mammals besides marsupials being a few species of a still lower type—the monotremes, and a few of the very smallest forms of rodents—the mice. The marsupials, however, are very numerous and varied, constituting 6 families and 33 genera, of which there are about 120 known species. None of these families is represented in any other continent; and this fact alone is sufficient to prove that Australia must have remained almost or quite isolated during the whole of the Tertiary period.

In birds there is, as we might expect, less complete isolation, yet

there are a number of very peculiar types. About 15 families are confined to the Australian region, among which are the paradise-birds, the honey-suckers, the lyre-birds, the brush-tongued lories, the mound-makers, and the cassowaries.\*

Our knowledge of the former mammalian inhabitants of Australia is imperfect, as all yet discovered are from Post-Tertiary or very late Tertiary deposits. It is interesting to find, however, that all belong to the marsupial type, although several are quite unlike any living animals, and some are of enormous size, almost rivalling the mastodons and megatheriums of the northern continents. In the earliest Tertiary formations of Europe remains of marsupials have been found, but they all belong to the opossum type, which is unknown in Australia; and this supports the view that no com-

\* The following is a summary of the peculiarities of the Australian fauna:—

Among Mammalia there are 8 peculiar families—6 of Marsupials and 2 of Monotremes. These are—*Dasyuridae*, *Myrmecobiidae*, *Peramelidae*, *Macropodidae*, *Phalangistidae*, and *Phascologyidae* (Marsupialia; *Ornithorhynchidae*, and *Echidnidae* Monotremata). In other orders there are a few peculiar genera. These are, 3 of bats, 2 being *Pteropidae*, confined to the Moluccas and Pacific Islands, and 1 of *Noctilionidae*, to New Zealand. Among rodents there are five peculiar genera, of *Muridae*, all found in Australia.

The peculiar families of birds are—*Pachycephalidae*, *Paradisidae*, *Meliphagidae*, *Drepanididae*, *Menuridae*, *Atrichidae* (Passeres)—*Cacatuidae*, *Platyceceidae*, *Trichoglossidae*, *Nestoridae*, *Stringopidae* (Psittaci)—*Didunculidae* (Columbæ)—*Megapodiidae* (Gallinæ)—*Rhinocetidae* (Grallæ)—*Casuariidae*, *Apterygidae* (Struthionies).

Peculiar genera of other families are numerous. There are 20 of *Sylviidae*, 4 of *Timaliidae*, 1 of *Certhiidae*, 3 of *Sittidae*, 2 of *Paridae*, 2 of *Oriolidae*, 3 of *Campephagidae*, 1 of *Dicruridae*, 9 of *Muscicapidae*, 2 of *Laniidae*, 9 of *Corvidae*, 1 of *Nectariniidae*, 1 of *Dicaeidae*, 3 of *Ploceidae*, 7 of *Sturnidae*, 1 of *Pittidae*, 2 of *Cuculidae*, 10 of *Alcedinidae*, 2 of *Podargidae*, 1 of *Caprimulgidae*, 5 of *Palæornithidae*, 15 of *Columbidae*, 7 of *Falconidae*, 6 of *Rallidae*, 1 of *Scelopacidae*, 4 of *Charadriidae*, and 6 of *Anatidae*.

Of reptiles there are 4 peculiar families, all small—*Pygopodidae*, *Aprasiidae*, and *Lialidae* (lizards), and *Rhynchocephalidae*, containing the lizard-like *Hatteria* of New Zealand. Among snakes *Pythonidae* and *Elapidae* contain many peculiar genera, while *Viperidae* and *Crotalidae* are altogether absent. Of lizards there are 36 peculiar genera, most of them belonging to the two families *Scincidae* and *Gekkotidae*. Of fresh-water turtles there are 3 peculiar genera.

Amphibia are not numerous, but there are a few peculiar genera, belonging to the families *Phrynsicidae*, *Engystomidae*, *Alytidae*, *Pelodyridae*, and *Bufo*nidae.

Fresh-water fish are also comparatively scarce. There is one peculiar family, the *Gadopsidae*, containing one species only. Most of the genera are peculiar, and they belong to the following families—*Trachinidae*, *Atherinidae*, *Mugilidae*, *Siluridae*, *Homaloptere*, *Haplochromidae*, *Galaxidae*, *Osteoglossidae*, *Symbranchidae*, and *Sirenoidei*.

Among insects, butterflies are scarce, except in the Moluccas and New Guinea. There are in all about 14 peculiar genera. Coleoptera are much more abundant, there being about 94 peculiar genera of *Carabidae*, 7 of *Lucanidae*, 3 of *Cetoniidae*, 20 of *Buprestidae*, and 260 of *Longicorns*. Land-shells are abundant in the islands, but comparatively scarce in the continent of Australia itself. There are only 3 or 4 peculiar genera, all confined to the islands of the Pacific.



munication existed between the Palæarctic and Australian regions even at this early period. Much farther back, however, in the Oolite and Trias formations, remains of a number of small mammalia have been found which are almost certainly marsupial, and bear a very close resemblance to the *Myrmecobius*, a small and very rare mammal still living in Australia. An animal of somewhat similar type has been discovered in rocks of the same age in North America; and we have, therefore, every reason to believe, that it was at or near this remote epoch when Australia, or some land which has been since in connection with it, received a stock of mammalian immigrants from the great northern continent; since which time it has almost certainly remained completely isolated.

The occurrence of the marsupial opossums in America has been thought by some writers to imply an early connection between that continent and Australia; but the fact that opossums existed in Europe in Eocene and Miocene times, and that no trace of them has been found in North or South America before the Post-Pliocene period, renders it almost certain that they entered America from Europe or North Asia in middle or late tertiary times, and have flourished there in consequence of the less severe competition with more highly developed forms of life.

The birds of Australia and South America only exhibit a few cases of very remote and general affinity, which is best explained by the preservation in each country of once wide-spread types, but is quite inconsistent with the theory of a direct union between the two countries during Tertiary times.

Reptiles are even more destitute of proofs of any such connection than even mammalia or birds; but in amphibia, fresh-water fishes, and insects the case is different, all these classes furnishing examples of the same families or genera inhabiting the temperate parts of both continents. But the fact that such cases are confined to these three groups and to plants, is the strongest possible proof that they are not due to land-connection; for all these organisms may be transmitted across the ocean in various ways. Violent storms of wind, floating ice, driftwood, and aquatic birds, are all known to be effective means for the distribution of these animals or their ova, and the seeds of plants. All of them too, it must be noted, are to a considerable degree patient of cold; the reverse being the case with true reptiles and land-birds which are essentially heat-loving; so that the whole body of facts seems to point rather to an extension of the Antarctic lands and islands reducing the width of open sea, than to any former union, or even

close approximation of the Australian and South American continents.

### *Summary and Conclusion.*

Let us now briefly review the conclusions at which we have arrived. If we could look back to remote Tertiary times, we should probably find that all our great continents and oceans were then in existence, and even bore a general resemblance to the forms and outlines now so familiar to us. But in many details, and especially in their amount of communication with each other, we should observe important changes. The first thing we should notice would be a more complete separation of the northern and the southern continents. Now, there is only one completely detached southern land—Australia; but at that period Africa and South America were also vast islands or archipelagos, completely separated from their sister continents. Examining them more closely, we should observe that the great Euro-Asiatic continent had a considerable extension to the south-east, over what are now the shallow seas of Japan, China and Java. In the south-west it would include Northern Africa, the Mediterranean then forming two inland seas; while to the west and north-west it would include the British Isles, and perhaps extend even to Iceland and Greenland. As a balance to these extensions, much of Northern Siberia and North-Western Asia may have been under water; the peninsula of India would be an island with a considerable south-west extension over what are now the Laccadive and Maldivé coral-reefs. The Himalayas would be a moderate range of hills, the great desert plateau of Central Asia a fertile plain, the greater part of the continent would enjoy a tropical or sub-tropical climate, while even the extreme north would support a luxuriant vegetation. This great continent would abound in animal life, and would be especially remarkable for its mammalia, which would comprise ancestral forms of all our existing higher types, along with a number of those lower grades of organisation (such as lemurs and opossums) now found chiefly in the southern hemisphere.

Connected with this continent by what is now Behring Straits and the Sea of Kamschatka, we should find North America, perhaps somewhat diminished in the east, but more extensive in the south and north, and abounding as now with great inland lakes which were situated to the west of the present lake district. This continent seems to have had a less tropical climate and vegetation than

prevailed in the eastern hemisphere, but it supported an almost equally varied though very distinct fauna. Ancestral horses no larger than dogs, huge tapir-like and pig-like animals, strange forms allied to rhinoceroses, the Dinocerata—huge horned animals allied to elephants and to generalised Ungulata, and the Tillodontia, still more unlike anything now living, since they combined characters now found separated in the carnivora, the Ungulata, and the rodents. Ancestral Primates, allied to both the lemurs and the South American monkeys, also inhabited this continent.

The great land masses of the northern hemisphere thus appear to have possessed between them all the higher types of animal life: and some of these seem to have been developed for a time in one continent, and then to have been transferred by migration to the other, where alone they have continued to maintain themselves. Thus the elephants and the camels appear to be descended from what were once exclusively American types, while the opossums were as certainly European. Many groups, however, never passed from the continent in which they originated—the civets, hyænas, and giraffes being wholly eastern, while the Oreodontidæ and Brontotheridæ were no less exclusively western.

South America seems to have been united to the northern continent once at least in Secondary or early Tertiary times, since it was inhabited in the Eocene period by many forms of mammalia, such as rodents, felines, and some ancient forms of Ungulata. It must also have possessed the ancestors of the Edentata (though they have not yet been discovered), or we should not find such a variety of strange and gigantic forms of this order in later Tertiary deposits in this part of the world only. During the greater part of the Tertiary period, therefore, South America must have been separated from the North, and thus protected from incursions of higher forms of mammalia which were there so abundant. Thus only does it seem possible to understand the unchecked development of so many large but comparatively helpless animals as the Edentata of the Pampas and the Brazilian caves—a development only comparable with that of the Australian marsupials, still more completely shut off from all competition with higher forms of life.

In Africa the evidence of a long period of insulation is somewhat more complex and less easily apparent, but, it seems to me, equally conclusive. We have, first, the remarkable fauna of Madagascar, in which lemurs and insectivora predominate, with a few low forms of carnivora, but none of the higher animals, such as apes, antelopes, buffaloes, giraffes, rhinoceroses, elephants, lions, leopards,

and hyenas, which swarm on the continent. The separation of Madagascar from Africa must therefore have occurred before these important groups existed there. Now, we know that all these large animals lived in Europe and Asia during late Miocene times, while lemurs are only known there during the Eocene period, and were probably even more abundant in late Secondary times. It is almost certain, therefore, that Southern Africa must have been cut off from Europe and Asia during the whole intervening period, or the same development of high forms and extinction of low would have gone on in the one country as in the other. The persistence of a number of low and isolated types in South and West Africa, which are probably a remnant of the ancient fauna of the country, is also favourable to this view.\* At the time we are considering, therefore, we must look upon tropical and South Africa, with Madagascar, as forming a completely isolated land or archipelago, while the Seychelles and Chagos banks, with Bourbon and Mauritius, perhaps, formed another island or group permanently separated from the larger masses. The extra-tropical portion of South Africa was also probably more extensive, affording an area in which its remarkable flora was being developed.

Turning to Australia, we should probably find it, at this remote period, more extensive than it is now, including in its area New Guinea and some of the adjacent islands, as well as Tasmania; while another extensive land may have occupied the site of the New Zealand group. It may be considered certain that, whatever elevations and subsidences these countries have undergone, they have not been connected either with Asia, Africa, or South America during the whole Tertiary period.

In conclusion, I would especially remark, that the various changes in the outlines and mutual relations of our continents, which I have now endeavoured to establish, must not be supposed to have been all strictly contemporaneous. Some may have been a little earlier or a little later than others; some changes may have been slower,

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\* These peculiar forms are, in West Africa, *Perodicticus* and *Arctocebus*, peculiar genera of Lemuridae—*Potamogale*, an aquatic form of Insectivora—*Potami* and *Nandinia* (Viverridae, and *Anomalurus* (Sciuridae). In South Africa, the *Chrysochloridae* or golden moles, most of the *Macroscelididae* or elephant-shrews, 3 genera of Viverridae (*Ariela*, *Cynictis*, and *Suricata*), *Proteles* forming the family Protelidae, *Hydrogale* one of the Mustelidae; *Dendromys*, *Malacothrix*, and *Mystromys* (Muridae); *Bathieryges* and *Heleophobius* (Spalacidae)—*Pedetes*, or the Cape hare (Dipodidae); *Petromys* (Echimyidae); and a species of *Orycteropus* (Orycteropodidae).

others more rapid; some may have had but a short duration, while others may have persisted through considerable geological periods. But, notwithstanding this uncertainty as to details, the great features of the geographical revolutions which I have indicated appear to be established by a mass of concurring evidence; and the lesson they teach us is, that although almost the whole of what is now dry land has undoubtedly once lain deep beneath the waters of the ocean, yet such changes on a great scale are excessively slow and gradual; so that, when compared with the highest estimates of the antiquity of the human race, or even with that of most of the higher animals, our existing continents and oceans may be looked upon as permanent features of the earth's surface.

The PRESIDENT said the Society might be congratulated on having heard in a compendious form, the principal results of the great work of Mr. Wallace on the distribution of animals throughout the globe. The views which had been expressed had been arrived at after a long and active life devoted to this branch of science. They showed how wide-reaching was the study of physical geography, to which the three lectures they had heard this Session had been devoted. The questions discussed by Mr. Wallace were so original and profound, and embraced such a variety of facts, that they must be content to recommend them to the serious consideration of the scientific world, and therefore they would very shortly be published in the 'Proceedings' of the Society. He was quite sure that all who had heard the lecture and felt its comprehensiveness, would be glad to have an opportunity of reading at their leisure the vast variety of facts that had been brought under their notice. There could be only one opinion as to the lecture being a very fitting continuation of those which had preceded it. It was the last of the series for the Session, and he trusted that the Society would feel that they had thoroughly realised the object that the Council had in view in instituting them. Want of time had prevented Mr. Wallace attempting to deal with the flora, but he had shown what an interdependence there was between the physical conditions of the earth and the distribution of animal life, and it was impossible to notice how peculiar that distribution was, without desiring to know something of the causes which had led to it. In order at all to comprehend the great physical problems that Mr. Wallace had dealt with, it was necessary to refer back to fossil and extinct life, as well as to the present distribution. Why should the camel and the date-palm be so especially distinctive of Arabia and Syria? Why should the elephant, tiger, and deadly cobra always be associated in the mind with India? Why should the lion, the giraffe, the antelope and the ostrich (although there were ostriches in America) be regarded as the types of animal life in Africa? So with regard to the country in which His Majesty must take the deepest interest: why was Brazil associated in the mind with the sloth, the humming-bird, the toucan, and many of the most beautiful developments of nature, both in animals and birds, which were not found in other parts of America? So with regard to Australia, which suggested the kangaroo and the gum-tree. Why should there be these distinctive types and these great peculiarities attached to particular parts of the world? Mr. Wallace had shown that in distant geological periods the present continents and islands were not continents and islands; for instance, there was undoubted evidence from fossils that Siberia and all the north-west of Asia

once enjoyed a tropical or subtropical climate, where the magnolia and all the great specimens of tropical life were abundant, though now the country consisted of sterile steppes and deserts. Mr. Wallace had shown considerable reason for believing that India was at one time, what probably many persons would be relieved to know it was now, isolated by an ocean that ran round it to the north as well as to the south; and that a portion of Arabia must at one period have been deep under the ocean. Italy and Greece, too, were once connected with Africa, as Spain undoubtedly was, while the Mediterranean formed two basins instead of one large sea. A good deal had been heard lately of an ingenious French engineer's idea for bringing the Sahara into the Atlantic basin, and exchanging a sterile desert for a deep navigable sea. There was very little doubt that at all events southern Africa was once entirely isolated from the north. These were very interesting facts, showing the strict interdependence between the geographical changes which took place long before man appeared upon the scene, and the distribution of life. Originally geography took very little account of the earth, except as it was the habitation of the human race; but even that led to inquiries as to why there were such different types of men, and those inquiries led deeper into questions of geology. Such considerations involved attention to a vast mass of facts, and geography, which dealt only with the surface of the earth, was but a very small part of the whole question. Facts must be co-ordinated which were not merely derived from the surface but from fossil remains. If a rhinoceros was found embedded high on the Thibetan ranges, it showed conclusively that that which was now covered with snow and ice must at one time have had a tropical temperature. All these things revealed by geology taught that the earth was not now what it was many unknown ages ago, but that it had undergone gradual changes. It perhaps was some consolation to know that these changes had been very slow in their progress. It was pretty evident from what Mr. Wallace had so well pointed out, that the earth was at present very much what it was as regards oceans and continents many millions of years ago. He was glad that the meeting had been honoured with the presence of the sovereign who stood at the head of the list of the Society's honorary members. The Emperor of Brazil had also honoured them the last time he was in England, and he had always been a very loyal and faithful member of the Geographical Society, and had given many evidences of the interest he continually took in the progress of science. No doubt His Majesty would be glad to see that endeavours were being made to extend the Society's work, and at the same time to give it a thoroughly scientific character. In conclusion he proposed a vote of thanks to Mr. Wallace for the intellectual treat he had afforded them.

The PRESIDENT then announced that the Meetings were adjourned until next Session, in November.

## ADDITIONAL NOTICES.

(Printed by order of Council.)

### 1.—*The Arctic Expedition of 1875-76.* By CLEMENS R. MARKHAM, C.B., F.R.S., Secretary R.G.S.

#### 1.—HISTORY OF THE EFFORTS TO OBTAIN A RENEWAL OF ARCTIC RESEARCH.

IN the following Paper I wish it to be understood that any views or opinions that may be expressed are my own, and that I am solely responsible for them.

When, in 1863, the Council of the Royal Geographical Society undertook to advocate and promote the exploration of the unknown region round the Pole, it was fully understood that the great work could only be accomplished gradually, and that one expedition must follow another until all the knowledge attainable by human means, in this field of inquiry, had been obtained. One important step in advance has been made by the discoveries of the Arctic Expedition of 1875-6; and it now becomes necessary to take stock of our increased knowledge, and by its light to consider the next step in advance that should be advocated.

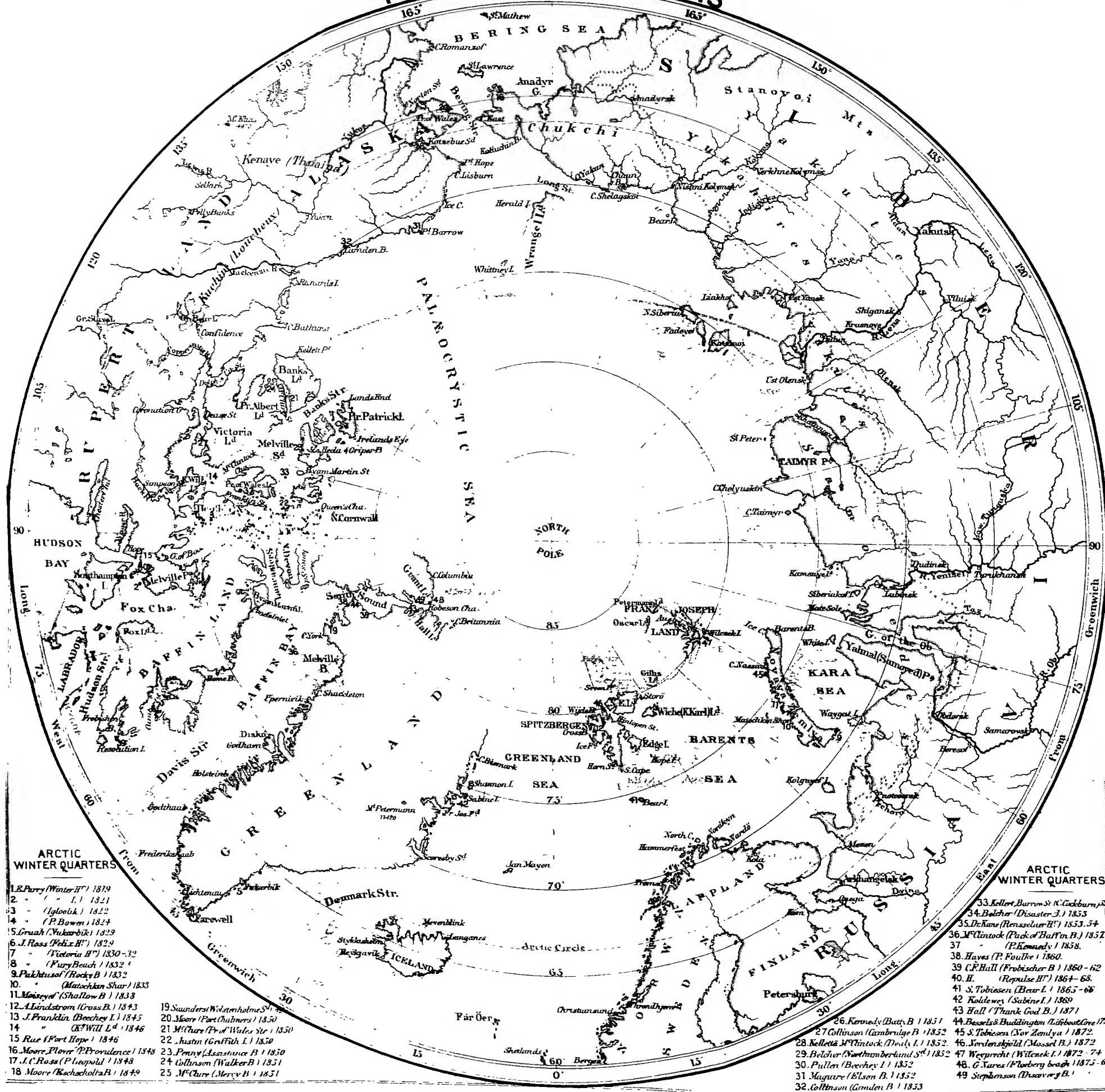
2. The duty of thus summing up the case at the termination of the first effort, would have fallen upon our lamented Associate, Admiral Sherard Osborn, had he been spared to us. He it was who first raised the question in 1865, who perseveringly and ably kept it alive, who by his winning eloquence and well-deserved influence won adherents, and who at length secured the despatch of an expedition by the route which he had advocated for ten years. His efforts were crowned with complete success, in the very year that he died. The cause of Arctic discovery has sustained a loss which cannot be replaced. We can no longer be sustained by that help which never failed; yet the memory of Osborn's cheery voice, and hearty joyous smile, which won upon men's feelings nearly as much as his close reasoning and well-marshalled facts affected their judgments, will nerve us still to do battle in the same noble cause.

3. I have undertaken to sum up and take stock of what has been achieved, partly as the constant assistant and adviser of Sherard Osborn from the day when he began to advocate the renewal of Arctic research in 1865, until the day of his death. But I do not take upon myself to assert that the views and opinions I now put forward are necessarily those which Osborn would have adopted; although we never differed while working together. We had been messmates during four years, we had served together in the same Arctic Expedition, and our friendship had stood the test of thirty years. When Osborn went to Bombay in March 1865, he entrusted all his notes and correspondence on the Arctic question to me, and he did so again on a later occasion. Together we discussed each point as it arose, every step that should be taken, and together we prepared the memoranda, drafts of letters, and reports which were adopted by the Council of the Geographical Society. So that the duty of discussing the question at the point it has now reached, which would have belonged to Osborn if he had been spared to us, does





# THE ARCTIC REGIONS



not unnaturally fall upon one who, in this matter, was his coadjutor and assistant.

4. It will be well, before marshalling our new knowledge, to recapitulate the history of our efforts to obtain a renewal of Arctic exploration, since their commencement in 1863.

5. In determining the policy to be pursued for securing the despatch of an Arctic Expedition, it was above all things necessary to ascertain the points which former Arctic experience has firmly established, and to formulate them, so as to have a firm stand-point from whence to start.

6. This experience bears upon the two main divisions of the subject, namely, the objects of Arctic exploration, and the means of securing those objects.

7. Formerly, and since 1775, the objects, or at least the main objects, of Arctic voyages had been to make the North-west Passage or to reach the North Pole. The last voyage for the former object left England in 1845, and for the latter in 1827. But the advance of knowledge had since proved that there could be no useful and tangible results either in making the North-west Passage or in reaching the North Pole. These objects had, therefore, to be finally discarded. It was quite clear that Arctic discovery would have no influential support from any of the learned Societies, without which success was impossible, if to reach the North Pole—an utterly useless quest—was its main object.

8. The objects of Arctic exploration, in these days, must be to secure useful scientific results; in geography by exploring the coast lines, and ascertaining the conditions of land and sea within the unknown area; in geology by collections and by a careful examination of the land; in zoology and botany by observation and by collections; in physics by a complete series of observations extending over at least a year.

9. Such being the scientific objects of Arctic exploration, they must be kept in mind when the rules for securing them, based upon long experience, are formulated. But there is another object which had great weight with Sherard Osborn. He specially dwelt upon the importance of encouraging a spirit of maritime enterprise, and of giving worthy employment to the Navy in time of peace—a truly national object, and one which, as the result proved, had as much influence in forming the decision of statesmen as the scientific results.

10. We now come to the means whereby the unknown Polar area is to be penetrated, and the desired success to be secured. The first great lesson taught by two centuries of experience is that no extensive and useful exploring work can be calculated upon by merely entering the drifting pack; and that effective progress can be made only by following a coast line. The second Arctic canon is that, to secure efficient work, at least one winter must be faced in a position beyond any point hitherto reached. This is essential in order to obtain series of observations of any value. The third rule is that mere navigation in a ship cannot secure the results desired from Arctic exploration, and that it must be supplemented by sledge-travelling. The exploration of 50 miles of coast by a sledge-party is worth more to science than the discovery of 500 miles of sea or coast by a ship. In the former case the land is accurately mapped, and its fauna, flora, geology, and physical features are ascertained. In the latter a coast is seen and its outline shown by a dotted line on a chart, and that is all. The two methods will not bear comparison.

11. The experience of centuries of Arctic research has thus resulted in the establishment of three canons, which form unerring guides to us who inherit that experience:

I. Navigate along a coast line, and avoid the drifting pack.

II. It is necessary to pass at least one winter at a point beyond any hitherto reached.

III. The ships must be looked upon merely as the base of operations, and sledges as the main instruments for discovery and exploration.

12. With the objects of Arctic research, and the means of securing those objects thus distinctly formulated; the next point was to decide by which route leading to the unknown area round the North Pole those essential conditions could best be found. In the first place, there must be coast lines leading into the unknown space both for navigation and for sledge-travelling. In the second place, there must be a prospect of finding suitable winter quarters beyond the threshold of the hitherto discovered region. At that time, Smith Sound, and the east coast of Greenland, alone met such conditions. Of these two, Smith Sound offered two coast lines for exploration instead of one; its navigation was believed to be less difficult, and to offer a better chance of securing winter quarters beyond the threshold of the unknown region, and finally the means of retreat, in case of disaster, were better by that route. The Smith Sound route was consequently the best by which to commence the discovery of the vast unknown area.

13. This was the train of reasoning by which we arrived at the conclusion, that to secure the true objects of Arctic discovery, and to make a successful commencement of the examination of the unknown area, the first expedition should proceed by the route of Smith Sound.

14. On the 23rd of January, 1865, after all these points had been most carefully investigated and considered, Sherard Osborn read his first Paper at a memorable meeting of the Geographical Society, on the Exploration of the North Polar Region. His proposal was that two steamers should be despatched to Smith Sound, that one should winter near Cape Isabella, and that the other should press up the western shore as far as possible. In the following spring, sledge-operations were to be directed over the unknown area. Osborn also enumerated the valuable results to be secured from Arctic exploration.

15. In the long and interesting discussion which followed the reading of the Paper, the views of Sherard Osborn received cordial support from Sir Roderick Murchison, General Sabine, Captain R. V. Hamilton, Captain Inglefield, and Dr. Donnet. They were opposed by Captain Richards, the hydrographer.

16. But in March 1865, Osborn was obliged to go to Bombay, leaving the cause in my less-experienced hands, and an opposition commenced, the text of which was two letters from Dr. Petermann. On April 10th, 1865, I read a Paper at a meeting of the Geographical Society on the Best Route for North Polar Exploration, in which I added some fresh arguments in support of Osborn's views. But Dr. Petermann's letters were also read, and, almost singlehanded (supported only by Sir George Back and Admiral Collinson), I had to defend the position against a number of Dr. Petermann's English supporters. These letters, which proved to be a disastrous apple of discord, might now be advantageously forgotten, if they had not been quite recently upheld by Admiral Richards as models of wisdom and logical reasoning.\* This makes it desirable that a refutation of each point in the two letters should be submitted.

17. Dr. Petermann's letters were written to advocate the Spitzbergen route for Polar exploration, that is, the despatch of vessels to the open pack, away from the land, to the north of the Spitzbergen group. In his first letter he assigns eight reasons for his preference for this route. The first is that the voyage from England to the North Pole is shorter by Spitzbergen; a matter which might be important to a company wishing to establish a line of packets between the two points, but which has no bearing on the question of explora-

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\* In the discussion after the reading of Sir George Nares's Paper, on March 26, 1877.

tion. The second is that the Spitzbergen sea forms the widest entrance to the unknown region. This is one of the strongest objections to the route, for the navigation must be conducted in a drifting pack away from land. The third allegation is that the Spitzbergen sea is more free from ice than any other part of the Arctic Regions. This statement is directly opposed to the evidence of every navigator who has ever reached the edge of the pack on those meridians. They have all, without a single exception, found an impenetrable barrier of ice between Greenland and Spitzbergen, and to the north of that group. The fourth is that the drift ice to the north of Spitzbergen offers just as much or as little impediment to navigation as the ice in Baffin's Bay. When it is remembered that no vessel has ever penetrated through the ice-fields north of Spitzbergen, notwithstanding numerous attempts, while a fleet of whalers has annually got through the Baffin's Bay ice since 1817, an idea may be formed of the value of this assertion. The fifth argument is that the sea north of Spitzbergen will never be entirely frozen over, not even in winter, nor covered with solid ice fit for sledge-travelling. This is really the strongest objection to the Spitzbergen route, for the constant movement of the ice away from land will make it impossible to winter in it, and most dangerous to enter it at all. The sixth assertion is that from Sir Edward Parry's farthest point a navigable sea was extending, far away to the north; and that old Dutch skippers rowed they had sailed to  $88^{\circ}$  N., and beyond the Pole itself. The statement respecting Parry is the very reverse of the real fact. That officer, at his extreme point, found the ice thicker and the floes more extensive than any he had previously met with; and there was a strong yellow ice-blink always overspreading the northern horizon, showing that the Polar pack still stretched away to the northward. The argument derived from the old Dutch skippers may safely be left to shift for itself. The seventh point is, that the Polar region north of Spitzbergen consists of sea and not land. This is a mere assumption; but, if correct, it is the very reason that the Spitzbergen route is the worst that could be selected. The eighth argument is that Parry's expedition occupied six months, a circumstance which can only have weight with those who prefer a hasty and perfunctory cruise to deliberate and careful exploration.

18. So much for the first letter. The second letter contains the following argument. Dr. Petermann urges that there will be no difficulty in boring through the Polar ice-fields north of  $80^{\circ}$ , because Sir James Ross got through an extensive pack in the Antarctic Regions in latitude  $62^{\circ}$ , after it had drifted and become loose for many hundreds of miles over a boundless ocean. The fallacy of this comparison was shown by Admiral Collinson\* at the time. Finally, Dr. Petermann asks for any reason, however slight, why it would not be as easy to sail from Spitzbergen to the Pole and back as to go up Baffin's Bay to the entrance of Smith Sound. The reason is clear enough, and is well known to all Arctic navigators. North of Spitzbergen any vessel pushing into the ice is at the mercy of the drifting floes and fields. In Baffin's Bay there is land-ice, along which a vessel can make progress while the pack drifts past. The consequence is, that while a fleet of whalers passes up Baffin's Bay every year, no vessel has ever penetrated through the pack north of Spitzbergen.

19. Such were Dr. Petermann's arguments. They had the effect of delaying the resumption of Arctic research by the English for ten years. For they were adopted by Admirals Belcher, Richards, Ommanney, and Inglefield; unanimity among Arctic authorities was thus destroyed, and, in Osborn's absence, success was obviously hopeless. I, nevertheless, prepared drafts of letters to other scientific Societies, and a most encouraging reply was received

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\* Royal Geographical Society's 'Proceedings,' vol. ix. p. 118.

from the Linnæan. I also drew up a letter to the First Lord of the Admiralty, which was signed by Sir Roderick Murchison, and the Duke of Somerset received a deputation. His Grace, however, naturally said that as Arctic authorities differed as to the route, the Admiralty could not decide that question; and that it would be better to wait for the result of the Swedish Expedition, which was then about to be sent to Spitzbergen.

20. It only remained to watch for another favourable opportunity of reopening the question. But Sherard Osborn, on his return from India in 1866, did not relax his efforts. Every endeavour was made to interest the general public in Arctic work, and, under Osborn's inspiration, I wrote an article in the 'Quarterly Review' for July 1865, and several reviews and articles on the subject between 1866 and 1871. Papers were also prepared and read at the annual meetings of the British Association in 1865 and 1866.

21. At last Sherard Osborn decided that the time had arrived for a formal renewal of his proposal; and at a meeting of the Geographical Society on April 22nd, 1872, he read his second Paper on the Exploration of the North Polar Area. The great point now was to secure unanimity among Arctic authorities, before approaching the Government on the subject: and the Paper was mainly intended to review the work of Swedes, Germans, and Austrians in the Spitzbergen direction since 1865; and to show that the theory maintained in Dr. Petermann's letters was in opposition to the practical experience of recent explorers. Those explorers had spoken with no uncertain voice. For instance, M. Nordenskiöld said that "the field of drift ice to the north of Spitzbergen consists of ice so closely packed together that even a boat cannot force its way between the pieces, still less a vessel, though propelled by steam. All experience seems to prove that the Polar basin, when not covered with compact unbroken ice, is filled with closely-packed unnavigable drift, in which, during certain very favourable years, some large apertures may be found, which apertures, however, do not extend very far to the north." Osborn quoted Nordenskiöld, Koldewey, and Payer as practical men; and again urged the adoption of the route by Smith Sound. On this occasion Sir Henry Rawlinson, then President of the Geographical Society, advocated the resumption of Arctic discovery, and ever afterwards not only co-operated with Osborn, but took a leading and active part in furthering the cause. Dr. Hooker and Dr. Carpenter dwelt upon the valuable scientific results of Arctic research. Sir George Back again warmly supported Osborn's views; and Admiral Richards, who had at the former meeting opposed the movement, now gave in his adhesion to it.

22. I then drafted a Report for the adoption of a Committee appointed by the Council of the Geographical Society to consider the best means of bringing the subject before the Government: consisting of Sir George Back, Admiral Collinson, Admiral Ommanney, Admiral Richards, Sir Leopold McClintock, Captain Sherard Osborn, Dr. Rae, Mr. Findlay, and myself.

23. In this Report the three canons of Arctic exploration were repeated, the various scientific researches were enumerated in detail, and all mention of reaching the North Pole as an object, was purposely excluded. The Smith Sound route was recommended as the best for exploring new coast-lines, and thus increasing geographical knowledge. The Report was unanimously adopted by all the members of the Committee, and also by the Council of the Society, on the 29th of April, 1872.

24. In July 1872 I began the work of editing the 'Geographical Magazine,' and my first number opened with an article by Sherard Osborn, on the renewal of Arctic discovery. In the same number I commenced the publication of the 'Threshold of the Unknown Region,' which was continued monthly until March 1873, and published as a separate volume in July 1873. The plan of this work had been conceived, and the greater part was written in

1865, but it was not then published. The second edition rapidly followed the first, the third edition appeared in January 1875, and the fourth in December 1875. The success of this little work proved the great change in public opinion which had taken place since 1865. A healthy interest in the glorious achievements of the Arctic worthies of former days was taking the place of sneering indifference, and Englishmen were once more becoming alive to the importance of maritime enterprise.

25. In August 1872, a Paper on the Renewal of Arctic Research, by Sherard Osborn, was read at the meeting of the British Association at Brighton.

26. On December 16th, 1872, Sir Henry Rawlinson and Sherard Osborn, accompanied by Dr. Hooker and a large deputation, had an interview with Mr. Lowe and Mr. Goschen, to urge the importance of despatching an Arctic Expedition; and the whole matter was fully explained both by Sir Henry and by Osborn. But the reply was unsatisfactory.

27. Official doubts were, however, on the eve of being overcome. All classes of the people, thanks to Osborn's exertions, were beginning to unite with men of science in the desire that the tradition of Arctic discovery should be preserved and handed down to posterity; and that Englishmen should not abandon that career of noble adventure which has done so much to form the national character, and to give our country the rank she still maintains. The interest, once very keenly felt in such enterprises, was rapidly being revived.

28. The year 1873 was one of much activity. On the 10th of February I read a Paper, at a meeting of our Society, on recent Discoveries east of Spitzbergen and on attempts to reach the Pole on the Spitzbergen meridians, in which it was shown that the best route for the objects which the Society had in view was by Smith Sound. On that occasion Sir Henry Rawlinson declared that the Society would recommend and promote the despatch of an expedition by way of Smith Sound, because by that route the widest extent of coast line would be discovered and explored, and the most important scientific results obtained.

29. The goal was now in view. A few more well-conceived efforts, and success was secured. Osborn found that the objection to which official and other persons most obstinately clung was based on the supposed dangers and difficulties of ice-navigation. He therefore came to the conclusion that nothing would tend more to dispel this objection than some practical proof or trial, and that it was desirable that a naval officer should proceed to the Arctic Regions in a whaler, and return with a full report of all he had seen and experienced. He selected for this service Commander A. H. Markham, who had been a volunteer since the question was first raised in 1865; and who now made a cruise with Captain Adams in the whaler *Arctic* from May to August, 1873. The publication of his narrative in 1874, '*A Whaling Cruise in Baffin's Bay and the Gulf of Boothia, with an Introduction by Rear-Admiral Sherard Osborn, C.B.*,' the second edition of which appeared in 1875, was another means of exciting public interest in Arctic work.

30. In the spring of 1873, a Joint Committee of the Royal and Royal Geographical Societies was appointed to prepare an exhaustive Memorandum on the scientific results to be derived from Arctic exploration, and on the reasons why such researches can best be accomplished by a naval expedition despatched under Government auspices. The Committee was composed of the same members as sat on the Arctic Committee of 1872 for the Geographical Society, and of Dr. Hooker, Mr. Busk, Mr. Prestwich, Dr. Carpenter, Dr. Allman, Mr. Evans, General Strachey, and Mr. Fergusson for the Royal Society. In this Memorandum, dated June 1873, which was widely distributed, the scientific results were fully discussed in a series of paragraphs furnished by Dr. Hooker, Professor Allman, Mr. Prestwich, General Strachey, and Professor Newton; while the arguments derived from former experience and general policy were

by Sherard Osborn. With these materials I drew up the Memorandum, which was unanimously adopted by the Joint Committee, and also by our Council. In this manifesto, as in that of 1872, the object was declared to be the exploration of as large an area as possible of the unknown region; while all allusion to attaining the highest northern latitude possible, or reaching the Pole, was again purposely omitted.

31. In August 1873, I read a Paper on the Importance of Arctic Exploration, at the meeting of the British Association at Bradford; and in the following October I contributed an article on the same subject to the 'Contemporary Review.'

32. The year 1874 was destined to see the complete success of the efforts of Sherard Osborn and those who had worked with him for the previous ten years. The Society, which had approved and encouraged these efforts, thus has the honour of having initiated, steadily and perseveringly advocated, and finally of having secured the adoption of a measure of great importance for the advancement of geographical knowledge.

33. On the 1st of August, 1874, Sir Henry Rawlinson and Admiral Sherard Osborn, accompanied by Dr. Hooker, had a very satisfactory interview with Mr. Disraeli, and on the 17th of November the Prime Minister addressed a letter to Sir Henry Rawlinson announcing that Her Majesty's Government had determined to lose no time in organising a suitable expedition; the two objects being the exploration of the region round the North Pole, and the encouragement of maritime enterprise.

34. The further measures connected with the equipment, and the instructions, then passed into the hands of the Admiralty. Two vessels were selected and prepared for ice-navigation, and officers and men were appointed between November 1874 and February 1875.

35. It is important that the objects of the Geographical Society, and the rules based on experience which guided us in our recommendations, should be kept in mind. The Council, in all its memoranda, discarded the attainment of the highest possible northern latitude and the attempt to reach the North Pole as useful objects. Such aims, by themselves, were considered to be devoid of interest as of utility. Our objects were to explore the largest area possible of the unknown region from a fixed base of operations, in order to secure useful scientific results. The Council, also, since 1872, by the unanimous advice of its Arctic Committees, discarded the Spitzbergen route, including an attempt to push into the Polar pack away from the land. The course advocated was to navigate along a coast line, to include the passing of at least one Arctic winter in the scheme, and to look to sledge-travelling as the main instrument of discovery and exploration. Consequently the Smith Sound route was, for the attainment of the above objects in accordance with these rules, the best that could be selected.

36. Such were the objects of the Royal Geographical Society, and there was every prospect that they would be secured. The Expedition was to proceed by the route recommended by its Council, the advanced ship was, if possible, to cross the threshold of the unknown region, and winter in a position beyond any point reached by former discoverers, and exploration was to be conducted over the unknown area from this base of operations, with a view to securing those valuable scientific results enumerated in our Memoranda, though only as a secondary object.

37. Thus the Arctic Expedition was an enterprise originated by the Geographical Society, and, on the whole, conducted in accordance with the rules and for the objects consistently and perseveringly advocated by its Council. These facts were fully and cordially recognised by Captain Nares before he started. The officers of the Expedition were entertained at dinner by the Geographical Club, and they received a hearty God-speed from the President,

Council, and Fellows of the Royal Geographical Society, before they sailed from Portsmouth on the 29th of May, 1875. But the great work of exploring the North Polar Region could only be accomplished gradually, and it was never expected from the Smith Sound Expedition that it would do more than explore as large a portion of that region as was accessible from its base of operations with the means at its disposal.

## II.—SUCCESSFUL RESULTS OF THE ARCTIC EXPEDITION OF 1875-76.

38. The Arctic Expedition returned in October 1876, after having succeeded in crossing the threshold of the unknown region by the Smith Sound route, established a base of operations beyond it, and explored the unknown area from the base to the utmost extent possible with the means at their disposal. As far as the main object of the Admiralty was concerned (that of attaining the highest northern latitude possible), the *Alert* had reached the highest north latitude ever attained by any ship; she had wintered farther north than any ship had ever wintered before, and Captain Markham had reached  $83^{\circ} 20' 26''$  N., a point nearer the North Pole than any human being had ever been before.

39. As regards the objects of the Geographical Society, namely geographical discovery and research, the results of the Arctic Expedition are recorded in the Report of Sir George Nares, in the two papers he has read at meetings of the Society, on December 12th, 1876, and March 26th, 1877, and in the Sledging Journals presented to Parliament. It is necessary to pass these results in review, before proceeding to consider the next step in advance that should be advocated, now that the work by the Smith Sound Route is completed.

40. It was found that the coast lines beyond Robeson Channel trended away to west and north-east, forming the shores of a frozen Polar Sea, and from the base of operations formed by the *Alert* in  $82^{\circ} 27'$  N. the members of the Expedition examined the coasts for a distance of 300 miles. Along the whole of this distance the ice of the Polar Sea was of the same character. Its existence was an unexpected and important discovery.

41. This ice was found to be from 80 to 100 feet in thickness, formed by continual additions from above (due to the annual snowfalls), which, by the increasing superincumbent weight, is gradually converted into snow-ice. Complete sections of the huge masses forced upon the shore were carefully taken, and they show the way in which the whole is formed, as well as its great age. These masses had been broken off from the large floes of ice, and were grounded in from four to ten fathoms along the whole coast. The process of formation of the ancient floes resembles that of glaciers, and the masses thus grounded had been chipped off from them. They in no way resemble the mere piles of broken-up hummocks that are often found on other Arctic shores. They are, in fact, icebergs broken off from fragments of floating glaciers, and have, therefore, received the appropriate name of FLOE-BERGS.

42. The *Alert*, in September 1875, had thus reached an impenetrable sea of ancient ice intervening between those lonely shores and the North Pole. It is not, however, one vast congealed mass never in motion, which would have been the case if it had been formed in a stagnant and confined sea. On the contrary, it is subjected to annual disruption, and to violent commotion during the summer months. Early in July the whole mass is in motion, driving backwards and forwards with the winds and currents, its main course being towards the east. The floes grind against each other and are broken in fragments, while, whenever the angular corners of any of the fields meet, there pools of water are formed. In September the frost sets in, and these



pools and narrow lanes are frozen over with ice that becomes about six feet thick during the winter; but motion still continues, and ridges of hummocks are thrown up between the floes. The stillness of the Polar winter does not prevail until late in October or November. Then a new formation of ice commences, and goes on for seven months, which far more than counterbalances the decay during the summer.

43. Captain Markham's memorable journey away from the land from April to June 1876, directly across the frozen Polar Sea, gave further opportunities of studying its character. It was found to consist of very small and rugged floes, separated by ranges of ice hummocks from 30 to 50 feet high, and sometimes a quarter of a mile wide, while the occasional streams of young ice at the foot of the hummocks were narrow and of small extent. The hummock ridges consisted of a vast collection of *débris* of the previous summer's broken-up pack ice, which had been refrozen during the winter into one chaotic rugged mass of angular blocks of every possible shape. The intermediate floes of ancient ice were very rugged, and, on Captain Markham's route, never as much as a mile wide. The largest floe that was seen was farther to the eastward, blocking up the opening of Robeson Channel, and was several miles in extent. The surfaces of the floes were studded over with rounded, blue-topped ice humps from 10 to 20 feet high, the depressions between them being filled with snow deeply scored into ridges by the prevailing wind.

44. Such is the nature of the great Polar Sea beyond the channels leading from Smith Sound, which was discovered by the Arctic Expedition of 1875-76. It is so totally different from the Polar pack met with north of Spitzbergen, that, with a view to that precision without which Physical Geography cannot make progress as a science, it was necessary that some distinctive term should be applied to it. This portion of the Polar Ocean was, therefore, named the PALÆOCRUSTIC SEA, or sea of ancient ice: a name which has now been adopted by geographers both in England and on the Continent.

45. Careful and diligent observation furnished some *data* by which a judgment might be formed of the probable extent of the Palæocrustic Sea. It is certain that land was not near to the north, because hills were ascended to a height of 2500 feet and upwards on clear days, and there was not a sign of land. But there are other considerations all tending to the same conclusion. There are no flights of birds to the north, which certainly would be the case if there was land; and the only living thing that was seen on the Palæocrustic Sea, by the northern division of sledges, was a little snow bunting that had strayed from the nearest shore. Further evidence is furnished by the fact that animal marine life almost ceases to exist in the ice-covered Polar Sea. The cold currents destroy whales' food, and there are no cetaceans. Except one or two stragglers, no seals were seen, consequently there were no bears; and no human beings have ever before trodden the shores of the Palæocrustic Sea. For the Eskimos, like the bears, depend on seals for their means of subsistence, and all traces of them, therefore, cease with the seals and bears, where the palæocrustic floes commence. The falcons, which prey on marine life, also entirely cease.

46. It is remarkable, however, that the Arctic land animals, both mammals and birds, are found up to the most northern point in 83° N., though in much smaller numbers than at Melville Island, and in other localities in the Arctic Regions farther south. Musk-oxen were found, and the wolves which always follow them. Foxes and many little lemmings, followed by the great snowy owls that prey upon them; the musk-oxen and lemmings both living on the purple saxifrage. There were also hares, ptarmigan, Brent geese, knots, turnstones, and the few birds living on the small fresh-water lakes. But here they all ended, and no birds took their flights to the northward. The Palæocrustic Sea is a sea of solitude.

47. The great extent of this Polar Ocean is assumed on the above grounds. There is also evidence that it is a comparatively shallow sea. The northern division of sledges, at a distance of forty miles from the land, found bottom in only 72 fathoms; and between that point and the shore several huge floebergs were observed, apparently rising out of the centres of floes which were probably aground. Another indication of the present shallowness of the Polar Sea is the general recent upheaval of the adjacent land. Drift wood was found far above any point to which it could have been carried by ice or water.

48. The shore of the Palæocrystic Sea to the westward, after culminating at Cape Colombia, trends away south of west; and it was deduced, from similarity of tides, direction of prevailing winds, and movements of the ice, that this trend continued south-westward towards Prince Patrick Island. Similar evidence as regards the drift of the ice, and the comparison of winds with those experienced by the *Germania* on the east coast of Greenland, led to the belief that the north coast, from the farthest point discovered by Commander Beaumont, also trended south to Cape Bismarck. A study of tides by Professor Houghton confirms this view.

49. As regards the distribution of land and sea within the unknown area, and its general hydrography, the discoveries of the Expedition are important. And it usually happens that when a new geographical fact is revealed, through the labours of scientific explorers, it is found that it harmonises with other isolated pieces of knowledge which previously stood alone, as it were, and were not intelligible without it. Thus the value of discoveries is scarcely ever confined to the work itself; but they throw light upon the true bearings of former work, and help towards the elucidation of far larger questions. As regards the Palæocrystic Sea discovered by the late Arctic Expedition, this is eminently the case.

50. Referring to the information gathered by former explorers, we find that Captain Collinson, in coasting along the Arctic shore of North America, discovered that similar ancient ice composed the pack bounding the lane of open water along which he was able to pass to the westward in the *Enterprise* in 1851. When he wintered in Camden Bay in 1853-54, he made an attempt to examine this ancient ice by sledging, but he was stopped on the second day by masses of broken-up hummocks and heavy uneven floes; in short, by obstacles similar to those which were encountered by the northern division of sledges in 1876. In 1850 Captain McClure, in the *Investigator*, actually ran up a lane of water leading into this pack, and had gone some distance before he ascertained the fearful nature of the ice on either side of him. He then made all haste to escape from it. The same ancient ice extends along the whole western side of Banks Island; and the *Investigator*, in daily and hourly peril of destruction, passed along between it and the cliffs, in the navigating season of 1851. The surfaces of the floes are described as resembling rolling hills, some of them a hundred feet from base to summit. Sherard Osborn describes this pack as "aged sea-ice, which may be centuries old, and it seems, from the want of outlets, likely to increase yet in thickness to an unlimited degree; the accumulated action of repeated thaws, and the almost constant fall of snow on the upper surface, giving it a peculiar hill and dale appearance." McClure, in one of his notices, warned those who might find it that if his vessel got into this pack she would never be heard of again, and should not be followed.

51. Mechem found the same ancient ice along the western shore of Prince Patrick Island in 1853. He describes it as "tremendous," and he came to the conclusion that the sea on which it floats was of great extent. He adds that "the character and appearance of the pack driven against the land, and in every direction to seaward, thoroughly convinced him of the impossibility of

penetrating with ships to the southward and westward, against such impediments." Here then was again the Palæocrystic Sea.

52. Standing by itself, as an isolated geographical fact, the heavy ice seen by Collinson, McClure, and Meham, failed to reveal the whole truth. With the above data alone before him, Sherard Osborn saw at once that no one who had penetrated elsewhere into the Arctic Regions had ever met with similar oceanic ice. He described it as a vast floating glacier-like mass, surging to and fro in an enclosed area, bounded on the south by the shores of North America, on the west by Wrangell Land, and on the east by Banks and Prince Patrick Islands. But where was the boundary to the north? Here Sherard Osborn needed the *data* furnished by the recent discoveries to guide him. In their absence he came to the conclusion, which was perfectly justified by the materials actually before him, that the ancient ice was formed in a land-locked sea, and that it was bounded to the north by land continuing west from Prince Patrick's Island.\*

53. The discoveries of the Arctic Expedition of 1875-76 have thrown light upon and explained all these interesting questions. We now know that the Palæocrystic Sea extends from the shores of North America to the north coast of Greenland, a distance of 1200 miles: for the gap of 400 miles which is still unexplored between Prince Patrick Island and the most western point reached by the Expedition, is a continuation of coast line or island, as is deduced from coincidences of winds, tide, and drift. The sea is also shown to be of great width, in short, a Polar ocean of vast extent.

54. Dr. Petermann† has recently endeavoured to explain these facts on the same principle as that adopted by Admiral Sherard Osborn, namely, that the Palæocrystic Sea is practically stagnant, and confined on all sides by land. Osborn from the data then before him, supposed the frozen sea off Banks Island to be of comparatively small extent, and that it was bounded to the north by a continuation of the Parry Islands. Dr. Petermann, in the light of the new discoveries, recognises the existence of a vast Palæocrystic Sea of far greater extent than Osborn supposed; but he also would confine it by hypothetical land extending from Greenland across the Pole to Siberia. But Osborn had grounds for his theory, which Petermann had not. The former authority had gathered from the officers of the *Investigator* that the ice was comparatively motionless, that it never went more than a few miles off the American coast, leaving a narrow belt of water, and that, directly the gale ceased, it surged back again with its edge grounded in 100 feet of water. We now know that this is only partially correct, and that in portions of the Palæocrystic Sea there is a drift to the east, although little of the ancient ice finds a means of escape. But Dr. Petermann's theory is dependent upon the stagnancy of a vast ocean, and militates against the deductions respecting the insularity of Greenland, based on a study of the tides.

55. The knowledge of the existence of the Palæocrystic Sea, due to the discoveries of the late Expedition, added to the discovery of Franz Josef Land by the Austrians, and to the German observations on the east coast of Greenland, enable us to comprehend, with a nearer approach to accuracy, the general relations of the Polar area to the rest of the world as regards the circulation of water and the distribution of land and sea. The drift eastward of the ice north of Grant Land seems to be due to the great flow of warmer water into the Polar area, which, as a cold current, seeks an outlet southward at every opening, owing to the Polar area itself being surcharged. The warmer water, flowing up between Greenland and Spitzbergen as a submarine current, appears to come to the surface along the Siberian coast, and, aided by the

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\* See 'Threshold of the Unknown Region' (4th ed.), pp. 188-195.

† 'Macmillan's Magazine.'

discharged volume from the rivers, it causes a current round the area from left to right, and also across from the eastern to the western hemisphere. Hence, probably, the tremendous pressure on Grant Land and the north shore of Greenland, as well as the drift eastward. But there is much yet to learn.

56. The geographical and hydrographical results of the Arctic Expedition are the most important, because they have a practical bearing on the general system of oceanic currents and of meteorology, and consequently form an essential part of a vast whole. Without a knowledge of the hydrography of the Polar Region, all the general theories of oceanic currents must be incomplete; and Arctic research is, therefore, necessary to a science which is of practical utility. But the Expedition brought home other results which are certainly not less interesting than those discoveries which immediately concern the Geographical Society. Among these may be mentioned the examination into the geological formation of the whole coast line on the west side of the Smith Sound channels from Cape Isabella to Cape Union, as well as of the shores of the Palæocrystic Sea on either side of Robeson Channel. Collections of rocks and fossils were made at every point, including a very complete Upper Silurian series, and the mountain limestone shells and corals of Cape Joseph Henry. But by far the most important geological discovery was that relating to the existence of tertiary coal in  $82^{\circ}$  N., and the former extension of miocene vegetation to that parallel. The Expedition also made an exhaustive collection of the biology of a region previously almost entirely unknown to science: the region north of the 82nd parallel, as distinguished from the Arctic countries to the southward. The whole *flora* of the new region has been brought home; and it must be remembered that meagre though this *flora* certainly is, Dr. Hooker has shown that it possesses special interest, in connection with the remarkable distribution of American and Scandinavian plants. The zoology of the newly-discovered region has also been exhaustively examined, and very complete collections made as regards mammalia, birds, fishes, insects, molluscs, crustacea, echinoderms, and a vast number of microscopic forms. In physics a complete series of meteorological, magnetic, tidal and other observations, covering a year, has been taken at two stations.

57. I now turn to the conduct and management of the Expedition which secured these valuable results. Consisting of two steamers admirably officered and manned, it had an advantage over former expeditions composed of sailing vessels towed by steam tenders. But, on the other hand, it suffered from several disadvantages; as compared with the last two expeditions employed in the search for Franklin. The sledge-equipments and the clothing were identical, and the provisions were equally good; but it appears to have been impracticable to get a steamer with the warming apparatus which was so conducive to health and comfort in former voyages. Another serious disadvantage in 1876 was the numerical weakness of the late, as compared with the two previous expeditions under Austin and Belcher. While the latter had an effective force of one hundred and eighty men, the work of the late Expedition was necessarily more restricted, owing to its being seriously under-manned in comparison. It only had one hundred and twenty men, including chaplains.

58. The most essential object in the conduct of an Arctic Expedition, and the crucial test of its success, is the crossing of the threshold of the unknown region, and the attainment of a position as a base of operations beyond any hitherto discovered. If this is achieved, success is certain. It may be slight or important; but some measure of success is certain, if a base of operations is established within the unknown region. The navigation of the channels leading north from Smith Sound is the most difficult of any that has been experienced in Arctic coast waters, and as soon as the Palæocrystic floes are met with north of the 82nd parallel, there is great and constant danger. To have brought a ship through all this, and to have found winter quarters on the

open and exposed coast of the Palæocrystic Sea, protected only by grounded floe-bergs which might at any time be driven higher up or swept away, was in itself a great success. No other Arctic navigator ever forced his ships through such obstacles, and brought them safely back again; and this establishment of a base of operations within the unknown region called forth all the highest qualities of a commander—inconstant watchfulness, great presence of mind, rapid yet cautious decision, and consummate seamanship.

59. The next service to be performed was the laying-out of depôts by autumn sledge-travelling; and in this the late Expedition excelled all that preceded it, whether the amount of work done, the duration of absence from the ship, or the special difficulties and hardships be considered.

60. Next to the establishment of a base of operations beyond any point previously reached, the most important preparation for exploration and discovery by sledges is the management of the Expedition during the long darkness of an Arctic winter, and the maintenance of the health and spirits of the men. The difficulties, in this respect, of the Expedition of 1875-76 were greater than any that had previously been encountered, because the winter was the longest and the most severe, and the continuous darkness was the most prolonged that had ever been endured in the Arctic Regions. Moreover, the absence of the warming apparatus supplied to former expeditions increased the difficulty of preserving health. When these special disadvantages are considered, the efforts of the commanding officers of the late Expedition to preserve the health and keep up the spirits of the men are deserving of high praise. Extemporised arrangements of various kinds provided for ventilation and washing, the greatest care was taken that the daily rations of lime-juice were actually drunk, special attention was devoted to the enforcement of regular exercise and to diet, and the recreation and amusement of the men were kept up with a zest and energy which was never surpassed in any former expedition. The management during an Arctic winter of unparalleled length and severity was admirable in all respects.

61. When the sun returned, the scheme for exploration by sledges was matured: and early in April 1876, under difficulties and exposed to an extremity of cold beyond anything that had been experienced in former expeditions, the sledging-parties left the ships.

62. In accordance with the Admiralty Instructions, it was incumbent upon Captain Nares to push his principal party due north over the Palæocrystic Sea, with the object of attaining the highest possible northern latitude. As there was no land, it was not possible to lay out depôts, and all supplies, together with boats, had to be dragged on the sledges. The Admiralty had impressed upon Captain Nares (*para. 15 of Instructions*) that, in the absence of continuous land, sledge-travelling for any considerable distance has never been found practicable. Yet in order to attain the main object of the Admiralty, the attempt had to be made. The farthest north hitherto reached was on July 23rd, 1876, when Parry got to  $82^{\circ} 45' \text{ N}$ . But this was during the summer, and the work was done without the endurance of serious hardships, although the weights to be dragged per man were very great, namely, 268 lbs. Captain Markham won the palm from Parry after he had held it for nearly forty-nine years. On May 12th, 1876, he reached  $83^{\circ} 20' 26'' \text{ N}$ , in the face of hardships and difficulties without a parallel in the annals of Arctic sledge-travelling. Thus gallantly and successfully were the Admiralty Instructions complied with by reaching the highest northern point ever attained by man.

63. Three other extended sledge-parties were organised to secure the true objects of the Expedition from the point of view of the Geographical Society, namely, the extension of geographical knowledge. One was to explore the unknown region to the westward of the base of operations to the farthest point

attainable; the second was to press eastward along the northern coast of Greenland; and the third was to examine the deep inlet named after Lady Franklin, which was believed to be a strait. All did their work admirably, and extended their explorations to the utmost limit, in two sad cases beyond the utmost limit of human endurance. They fully, completely, and with heroic self-devotion, fulfilled the objects of the Geographical Society, by exploring that portion of the unknown region accessible by the Smith Sound route to the farthest extent possible with the means at their disposal.

64. The only competent judges of their work, from the point of view of actual experience in sledge-travelling, are the officers who served in former expeditions; and it is, therefore, desirable to quote here the opinion of Captain R. V. Hamilton, R.N., C.B., who served in the Arctic Expeditions of 1850-51 and 1852-54, and commanded sledges during three seasons. His evidence is as follows:—"I have no hesitation in expressing my admiration for the zeal, energy, and brave determination of Commander Markham and Lieutenant Beaumont and their crews to overcome the unprecedented obstacles they encountered—in my opinion very far greater than any previous sledge-parties have experienced. The journeys were extended to the utmost limits of safety—prudence would have dictated an earlier return, not doing so is the only fault (if a fault) committed. No officer could have pushed on so far unless thoroughly supported by his crew; no crew would have supported their officer had he not shown he exacted nothing from them he did not perform. Lieutenant Aldrich does not appear to have encountered, except from soft snow, greater obstacles than previous parties of the *Assistance* and *Resolute*. Had his men been in as good health as ours were, I believe his average distance would have been little less than my own in 1853 after a previous spring's experience of travelling. When the scurvy prostrated most of the crew, they displayed equal courage and patience under trial as the other parties. Till I read these journals, I had an impression on my mind *we* would have done better; but no unbiassed person can read these modest, unassuming narratives and retain that impression."\* I cannot refrain from adding the verdict of an able writer in the 'Quarterly Review,' which expresses the opinion of every true Englishman on this subject. "Surely nothing finer was ever recorded than this advance of three sledges, one to the north, another to the east, a third to the west, laden down with sick and dying men, in obedience to an order to do their best in their separate directions. And nothing more touching was ever penned than the narratives, full of tenderness and simplicity, in which the sailor-writers tell their story. These gallant seamen have failed to reach the Pole, but they have won a proud place in their country's annals. They have done Englishmen good."†

65. The unprecedented and most unexpected outbreak of scurvy, both among the men and officers who remained on board, and among the sledge-travellers, was a calamity, which enhances our admiration of the amount of useful work actually accomplished by the Arctic Expedition of 1875-76. The exciting cause of scurvy is very generally believed to be the absence of fresh vegetables, and this exciting cause existed in all previous Arctic Expeditions exactly in the same measure as in that of 1875-76. The predisposing causes are all conditions inimical to health which exist during an Arctic winter, including intense cold, long darkness, absence of fresh provisions, damp and confined air. These also existed in former expeditions when scurvy did not appear, but never during anything like the same length of time. It was undoubtedly the prolonged duration of these predisposing causes which produced the outbreak.

\* Evidence before the Scurvy Committee; Question No. 3991.

† 'Quarterly Review,' January 1877; Art. v. p. 185.

66. But this could not possibly have been foreseen. At the end of the winter the medical officers believed all the sledge-travellers to be in perfect health; and consequently, in arranging their dietary, Captain Nares was fully justified in the assumption that the conditions were identical with those existing in previous expeditions, and in following the best former precedents. Accordingly he adopted the scale of diet, including preserved potatoes as an antiscorbutic, but not including lime juice, which long experience had shown to be the best. It was exactly the same scale as had been used in former expeditions and as was recommended by Sir Leopold McClintock, except that the allowance of rum was decreased by one-half, and that of tea proportionally increased. No sledge-parties had ever before been disabled by scurvy, and none had ever taken lime juice as a daily ration. Hence there is no mention of scurvy, and no allusion to precautions against it, in the instructions drawn up for the guidance of former sledge-travellers, by the Arctic medical officers. The lime juice was supplied in jars and bottles, and the contents of each bottle became solid masses in an Arctic April, which cannot be used until thoroughly thawed and re-mixed.\* This would entail the use of additional fuel, and a serious increase of the weight to be dragged on the sledges. But the great objection to the daily thawing of rations of lime juice is the additional hardship and misery it would cause. No one who has not travelled during April in the Arctic Regions can have any idea of the sufferings it entails, especially upon the cook, and of the importance of doing nothing to increase that suffering, after a long day of intense toil.

67. These were the reasons why daily rations of lime juice were not included in the sledge-dietary by Captain Nares; and, from the point of view of the experience and information before him, and from which he had to form his decision, he was undoubtedly right. It is, I believe, the unanimous opinion of all Arctic sledge-travellers that Captain Nares did not commit an error of judgment on this point, and that he had no reason to deviate from the lessons of former experience.

68. It has been alleged that he received instructions to issue daily rations of lime juice to the sledge-travellers, from the Medical Director-General, Sir A. Armstrong. This is not the case. He was furnished with a memorandum of hints and suggestions by the Director-General simply for his information, but not for his guidance, and they were not instructions. He was also furnished with similar hints by another equally high Arctic medical authority, in which no such advice was given. The decision was properly left entirely to his own discretion. The suggestion of Dr. Armstrong was in opposition to all former practice and experience, and consequently, if its adoption was considered indispensable by that official, he ought to have given Captain Nares some reason for deviating from former precedents. Above all, he ought to have suggested means of using the lime juice while travelling in April; for unless this was done, the mere advice to drag it on the sledges was useless. It now appears that lime juice can be taken in lozenges, in biscuit, or in the pemican; but this ought to have been thought of by those who considered its use indispensable to sledging-parties, before the Expedition sailed.

69. The unexpected outbreak of scurvy was the one single calamity in an otherwise successful expedition. As soon as it was known, every precaution was taken to check its progress, and, thanks to the skill and untiring watchful care of the senior medical officer, there was not a single man on the sick list

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\* In an experiment at Netley the lime juice is reported to have frozen homogeneously. In the Arctic Regions this is not the case. The component parts are separated in the freezing process, owing probably to its much greater rapidity; and the whole volume must consequently be thawed and re-mixed every time it is used.

when the ships arrived at Portsmouth. All sledge-parties which went away in the warmer months were of course supplied with daily rations of lime juice, and the fact that scurvy nevertheless broke out, seems to be a conclusive proof that the original outbreak was not due to the want of lime juice on the sledges, but to causes which were in operation, though undetected, before the sledges started, causes due to the unparalleled duration of winter darkness.

70. The outbreak of scurvy, however, was not an unmixed evil. It has taught lessons which will be of great value hereafter, and the elaborate investigations of the Scurvy Committee ought to produce results which will be useful in the conduct of future Arctic Expeditions. Nor should the examples of heroism called forth by the terrible sufferings of the sledge-travellers be overlooked. They have added to the prestige of our Navy, and will have an enduring value. The 'Quarterly' reviewer says most truly "they have done Englishmen good."

71. At the conclusion of the sledging-season, in August 1876, Captain Nares was able to review the work that had been accomplished. The outbreak of scurvy had made it his imperative duty to return to England, in order to avoid a certain and serious loss of life which would have been utterly unjustifiable. But even if perfect health had been happily maintained, it would have been his duty to return. For the work was done, and done thoroughly. As regards the objects of the Admiralty, the highest northern latitude ever attained by any human being had been reached, and it had been found impracticable to advance farther towards the Pole by the Smith Sound route. The exploring work desired by the Royal Geographical Society was satisfactorily completed. A point had been reached to the westward beyond which exploration would be better conducted by another route. To the eastward a point was attained beyond which further discovery must be made by the route on the east coast of Greenland. The true objects of the Expedition, namely, to explore that portion of the unknown Polar Region which was accessible by the Smith Sound route, were fully secured. The nature of the ice in the Palæocrystic Sea, and of the newly-discovered coast-lines, showed that this part of the Polar Ocean was not navigable; and the officers of the late Expedition were forced to the same conclusions on this point as had formerly been arrived at by McClure and Meham. Consequently it was the duty of Captain Nares to obey the order contained in the 18th paragraph of the Admiralty Instructions, namely, "to use his best endeavours to rejoin his consort in 1876, and to return to England, provided that the spring exploration has been reasonably successful." After overcoming the same difficulties and dangers in the return voyage as had been encountered in 1875, the Expedition returned to England in October 1876, and received that cordial and hearty reception which its great success, its valuable geographical and other results, and the admirable conduct of officers and men, had so fully earned for it. The numerous testimonies to its success from the highest English authorities might be open to a suspicion of partiality, and I therefore prefer to quote the calm and impartial verdict of Chief Justice Daly, the President of the American Geographical Society. It is that "by the geographer and man of science the voyage will be pronounced a most important and successful one."

72. There is one result of the late Expedition which, though mentioned last, is not the least important. It was one which I know was very near to the heart of Admiral Sherard Osborn, the originator and chief promoter of the Expedition. I allude to the creation of a new generation of Arctic experts. The older generation is fast passing away, and if it had not been replaced, the traditions of the work would have died out. Now we once more have a supply of experienced ice-navigators and sledge-travellers, trained in the best school, where they have done their work right well, and who are willing and ready to face new dangers, and to win new laurels in the Polar Seas.



73. Thus the first great step has been accomplished by the Royal Geographical Society. Arctic discovery has been revived, an Expedition has been despatched, has completed its work, and has returned with a valuable increase to geographical knowledge. It remains for the Society to consider the next step, and to take care that this one success shall not be a spasmodic effort, but the commencement of continuous work in the same direction, to be persevered in until it is complete.

### III.—ROUTES FOR FUTURE ARCTIC EXPEDITIONS.

74. The arguments for the continuance and completion of Polar discovery are the same as those for its renewal. If Her Majesty's Government considered that the encouragement of maritime enterprise and the exploration of the Polar Region were objects of sufficient importance to justify the despatch of an Expedition to commence that work in 1875, those objects still exist, and the arguments for continuing and completing the work are quite as strong in 1877 as they were in 1875. Indeed, the success of the Expedition of 1875-76, and the experience gained by it, give new strength to those arguments; while the recent discoveries add fresh interest to Arctic research, and give additional scientific importance to its completion.

75. The discovery of the Palæocrystic Sea, and of 300 miles of its desolate shores, has entirely altered preconceived ideas, and added materially to our knowledge of the Polar area. But this increased knowledge is still very partial, and one of the most interesting objects of future research will be to ascertain the extent of the sea of ancient ice, and the laws which regulate its formation.

76. The knowledge acquired in 1875-76 fully confirms the accuracy of the rules based on long experience, and formulated by Sherard Osborn in 1865. The necessity for navigating along a coast line in order to cross the threshold of the unknown region, has received additional confirmation; the valuable results brought home by Captain Nares could not have been secured without wintering in the ice, and the use of sledges for exploring and making discoveries has again been shown to be indispensable. It is, therefore, established that the rules which guided the Council of the Royal Geographical Society in selecting Smith Sound as the best route and in recommending the course to be pursued, must still be considered in full force as guides for the selection of the next best route, and for laying down the principles on which Polar research should be continued.

77. It is now more certain than ever that the course advocated in Dr. Petermann's letters of 1865, namely, that of attempting to enter the drifting pack north of Spitzbergen in a steamer, in the hope of reaching a very high latitude, must be finally discarded. In the first place the object is insufficient. None of the results desired from Arctic exploration would be obtained by a summer cruise of this kind, away from land, even if it was successful. In the second place all practical navigators who have undertaken scientific investigations in the Spitzbergen seas since 1865, including Nordenskiöld, Koldewey, Payer, and Lamont, have declared that it will not be successful; and the opinions of Dr. Petermann himself appear to have been modified since that date. I have already quoted the views, based on great local experience, of Professor Nordenskiöld.\* Those of Lieutenant Payer entirely coincide. He holds that navigation in the frozen seas remote from the land is far more dangerous than navigation along a coast line, that it is entirely dependent on accident, exposed to grave catastrophes, and without any definite goal. "All the unsuccessful attempts," he adds, "to penetrate northward from Spitzbergen, were made by expeditions whose course and termination resemble each other as one egg

\* See page 540.

resembles another." Payer repeats what Sherard Osborn had urged since 1865, and what ought now to be accepted as an incontrovertible canon of ice-navigation. In the words of Sir Edward Parry, "experience has clearly shown that the navigation of the Polar Seas can never be performed with any degree of certainty without a continuity of land. It was only by watching the openings between the ice and the shore that our late progress to the westward was effected (in 1819), and had the land continued in the desired direction, there can be no question that we should have continued to advance, however slowly, towards the completion of our enterprise."

78. We must, therefore, continue to be guided by those canons of Arctic exploration which Sherard Osborn has formulated. But it must be remembered that the Smith Sound route was the best by which the threshold of the unknown region could be approached. The work in that direction is now completed, and the next best route cannot of course offer the same chances of success and equal advantages. The difficulties will increase as the work approaches completion; but so will the glory of surmounting them.

79. Four routes now remain for future expeditions. I. The Jones Sound route, the work of which will be to connect North Lincoln with Aldrich's farthest, and to ascertain the limits of the Palæocrystic Sea in that direction. II. The East Greenland route, to connect Cape Bismarck with Beaumont's farthest, and so complete the discovery of Greenland. III. The route of Franz Josef Land, to explore the northern side of the country discovered by Payer; and IV. The North-east Passage, by which a knowledge of the sea north of Siberia will be completed, and Wrangell Land will be explored.

80. The two latter routes will probably be found the most difficult, and it is not likely that all the work in either of those directions could be completed by one expedition. Payer and Weyprecht only reached the land discovered by them in 1873 by dint of a long and involuntary drift in the ice. It might be reached by a fortunate and skilful attempt either by the north coast of Spitzbergen or to the eastward, according to the season. If a winter harbour could be reached on the western shore of Franz Josef Land, discoveries of great interest would be made by sledging-parties, and annual communication might be secured by forming depôts on Gillies Land and other islands probably intervening between North-east Land and Zichy Island. Franz Josef Land seems to be a part of the Spitzbergen group, rising out of the same shallow sea, with deeper water to the north. But the exploration of its northern face will be very interesting, and will throw much light on the physical geography of the still unknown portion of the Polar area.

81. The North-east Passage is surrounded with a halo of romance. It was the first achievement attempted by our earliest Arctic worthies and by the Dutch, and is connected with the names of Willoughby and Chancellor, of Pet and Jackman, of Barents and Linschoten. In later times the labours of Lutke, Nordenskiöld, Gardiner, Wiggins, and the Norwegian walrus-hunters have given fresh interest to its approaches; the journeys of Anjou and Wrangell have shown the great geographical interest which attaches to the sea north of Siberia; while the admission of an indication of Wrangell Land on the charts has made its complete exploration a necessary work for the future.

82. Since 1869 the voyages of Norwegian fishers have overcome the obstacles on the threshold of the North-east Passage, which were insuperable to the early navigators. They have sailed round Novaya Zemlya, and have traversed the Kara Sea. The point is to select the right time in the season for an attempt to cross the Sea of Kara. It has now been established by M. Nordenskiöld and Captain Wiggins that a steamer may always calculate upon being able to reach the mouth of the Yenisei River in August. It remains to be seen whether navigation can be extended round Capes Taimyr and Chely-

uskin to the northern shores of the New Siberian Islands. Russian vessels have never been able to get beyond the mouth of the Pyasina. But in 1843 Middendorf saw extensive open water from Cape Taimyr during the summer, and the observations of both Anjou and Wrangell tend to the conclusion that, if Cape Chelyuskin could be rounded, the Polar Sea north of Siberia might be navigated as far as Wrangell Land. The difficulties of crossing the threshold of the unknown region, and reaching new ground by this route, will doubtless be formidable. Nevertheless, important discoveries will reward the future explorer who boldly and successfully advances northwards on this line. He will be in the rear of the ice-laden Polar Sea discovered by the Expedition of Captain Nares, and will thus complete the solution of the questions in Physical Geography connected with it.

83. It is, however, the first two routes that I have mentioned which offer the greatest advantages, and most nearly comply with the conditions that have been laid down; namely, those by Jones Sound and by the east coast of Greenland. By both the navigation would be along coast lines, and by both there is a reasonable expectation of being able to establish a base of operations beyond the threshold of the unknown region. Discovered by Baffin in 1616, Jones Sound is said to have been penetrated by Captain Lee in the *Prince of Wales* whaler in 1848, for a distance of 150 miles. In August 1851, Sherard Osborn went a short distance up Jones Sound in the *Pioneer*, but was stopped by floes stretching across the strait; and it was also entered by Inglefield in the *Phoenix* in 1853. In the spring of 1853, Sir Edward Belcher explored the north coast of Grinnell Land, which forms the southern side of Belcher Channel leading from Jones Sound. He found open water streaked with sailing ice, and the northern coast or islands trending to N.E. The floes were acted upon by a strong tide, and had evidently been in motion during the previous autumn. Early in June the flights of birds indicated water-holes to the north, probably caused by the passage of a strong tidal wave in an east and west direction. The geographical results of an expedition up Jones Sound and Belcher Channel would be the completion of discoveries thence to Aldrich's farthest, including the distribution of land and sea towards Prince Patrick Island, and the character of the region north of the Parry group. The attainment of a suitable base of operations for the sledging-journeys is almost certain, so that some measure of success by the Jones Sound route may be relied upon.

84. But, with equal advantages as regards the chances of success, the East Greenland route offers geographical results of greater importance, namely, the completion of the discovery of that vast mass of glacier-bearing land. The northern known part of East Greenland was discovered by Henry Hudson on June 13th, 1607, who called it "Hold with Hope," and reported that, "for aught we could see, it is like to be a good land and worth the seeing." This was in latitude  $73^{\circ}$  N. Van Keulen, on his chart, has "Land van Edam" in  $77^{\circ} 10'$  N., discovered in 1655; and another part of the coast, seen in 1670, marked "Land van Lambert." In June 1822, Scoresby forced his ship through the ice-floes which encumber the east coast, and surveyed it from Gale Hamke's Bay in  $75^{\circ}$  southwards to  $69^{\circ}$  N., finding little difficulty in sailing along the channel close inshore. In the following year, also during the month of June, Captain Clavering in the *Griper*, with Captain Sabine on board, attempted to press through the ice to the east coast of Greenland in  $77^{\circ} 90'$  N., but was stopped by an unbroken field sixty miles long. On August 2nd, he again entered the ice in  $75^{\circ} 30'$  N., and passed through sailing ice, along the margin of solid fields, to the south-west, at last succeeding in reaching the land. He laid down the coast line from  $72^{\circ}$  to  $76^{\circ}$  N., while Captain Sabine took his observations on Pendulum Island.

85. The German Expedition sailed from Bremen on June 15th, 1869, con-

sisting of the *Germania*, a little steamer of 140 tons, and with a crew of seventeen men, and the *Hansa* storeship. The crew of the *Hansa* demonstrated the existence of a southerly drift along the east coast during the winter; while the *Germania*, following in Captain Clavering's footsteps, reached a latitude of  $75^{\circ} 30' \text{ N.}$ , and wintered at the Pendulum Islands in  $74^{\circ} 30' \text{ N.}$  By the 5th of August the *Germania* reached open water inshore, but the ice appeared to be firm and without sign of breaking up, to the north of Shannon Island ( $74^{\circ} 56' \text{ to } 75^{\circ} 26' \text{ N.}$ ). To the south there was much open water. From August 17th to September 13th an attempt was made to go farther north, but without success, the fields being closely packed against the land-ice. In 1870 a sledging-journey (two sledges and ten men) was undertaken to the northward, between March 8th and April 27th, the first twenty-three days outwards taking the party to  $77^{\circ} \text{ N.}$ , the most northerly point ever reached on the east coast. Nothing but want of provisions (for they had no system of depôts) prevented a much further extension of the journey to the northward.

86. The opinion of the German explorers is unfavourable to the possibility of pushing much farther north along the east coast. But all depends on the season, and on vigilance in watching for and taking advantage of a lead. In 1872, Captain David Gray, of Peterhead, in the whaler *Hope*, saw a wide extent of open water, with a water sky to the northward, on this east coast; and in 1874 he reported a great and unusual drift of the ice in the Spitzbergen Sea.

87. On the whole, the East Greenland route ranks next to Smith Sound, as a promising direction to take with a view to exploring an important section of the unknown Polar area. It complies with all the conditions of success—navigation along a coast line, possibility of finding winter quarters beyond the threshold of the unknown region, and the means of exploring by sledge-parties. A depôt ship would be established at or near the Pendulum Islands, while the advanced vessel would only have to reach about the 78th parallel in order to be within the unknown area, and so to make some measure of success certain. The recent investigation ought to ensure immunity from scurvy, and with a healthy crew the sledging-operations over such ice as is described by the Germans could be extended four degrees farther north at least, to the 82nd parallel. This would bring them within a short distance of Beaumont's farthest, and the discovery of Greenland would thus be completed—one of the most important geographical achievements that remains to be accomplished by this generation. The east coast is reported to be frequented by musk-oxen, and its ice-floes by bears and seals; so that the explorers would be able to obtain fresh provisions, while the winter darkness would be much shorter, and the climate less rigorous than that to which the late Expedition was exposed. The magnificent mountains and fjords of this east coast present features of peculiar interest in several branches of science, and it is probable that the various discoveries made by explorers who will complete the circuit of Greenland will be of great value.

88. On the whole, then, the East Greenland route is the best that can be selected for a new Expedition; because it offers greater facilities and better chances of success, and also because by it the important discoveries of the Expedition of 1875-76 will best be followed up and made continuous. But there are at least four routes from which to select, namely those of Jones Sound, East Greenland, and Franz Josef Land, and the North-east Passage. The reasons for continuing the work are as strong as those for commencing it; and I would earnestly submit that the Council of the Royal Geographical Society ought not to relax its efforts after one success, but that there should be continuity in its measures, and that, through good report and evil report, it should steadily persevere until the exploration of the unknown region round the North Pole is completed.

2. *Notes of Recent Journeys in the Interior of South America.*

By ALFRED SIMSON.

## I.—FROM GUAYAQUIL TO THE NAPO, BY THE UPPER PASTASSA ROUTE.

THE narrative of travel which I have to offer to the Society refers to a portion of our globe almost incomparable in its geographical and general scientific interest; by no means a newly-discovered territory, but one which has formed, perhaps, the principal and most interesting field of the labours and investigations of a great leader of modern cosmical research, Alex. v. Humboldt.

Notwithstanding that the Republic of Ecuador has been visited by many other eminent naturalists—La Condamine, Wisse, Hoff, Bourcier, and quite recently the geologists Wolf, Reiss, and Stübel,—to the general public even its most superficial structure is quite a sealed book, though I venture to say that in no part of our world can the configuration of the earth's surface be seen on such a grand and varied scale. I shall endeavour to illustrate this by the description of portions of my wanderings through its almost inaccessible passes, rich tropical valleys, bleak snow-capped heights, fertile and desert plains and foaming rivers, from the Pacific Coast to the limits of its interminable forests on the borders of the Amazons.

Although the greatest dimensions of Ecuador are included in only seven degrees of latitude and a little over ten of longitude, with the equator running through its centre, and taking its present practical, or I may say *actual* limits, as I lately demonstrated on a map belonging to this Society, much less, the longitude being reduced by fully two degrees, we find it to contain every kind of climate and soil, with exceptionally rich and consequently varied fauna and flora.

I must remind my readers that the great mountain range which commences in Tierra del Fuego and runs up to our dominions in North America, upon entering Ecuador from the south, divides into two distinct chains, with a high table-land or valley between, assuming here throughout its grandest and most imposing forms and dimensions. These two ranges, which separate the waters flowing to the Pacific from the more important rivers which contribute to the Atlantic, contain, in no more than 300 miles of length, over twenty mountains, and a much larger number of peaks, reaching an elevation greater than 15,000 feet above the sea-level, and consequently eternally snow-capped: all of volcanic formation excepting two, the Saraureu and Cerro Hermoso.

Here we find volcanoes and volcanic productions in every stage. Immense plains of volcanic sand, mountains and vales of tuff and scoræ—in some of the lower strata of which are imbedded numerous animal remains of the quaternary period,—streams of lava, fields of pumice, and the great cones themselves; some extinct, others smoking and dormant, and one in unceasing activity. Not less interesting is a peculiar case in actual progression, known to geologists as “secular sinking.”

To impart a definite idea of the magnitude of the two ranges of the Equatorian Andes, I will enumerate a few of the most important mountains, with their respective measurements, the most recent taken—and I am inclined to believe the most correct—by Messrs. Reiss and Stübel.

The western range contains, among others, the—

Chimborazo	.. ..	20,697	feet above the sea-level.
Iliniza	.. ..	17,400	”
Carguairazo	.. ..	16,748	”
Cotacachi	.. ..	16,288	”
Corazon	.. ..	15,796	”
Pichincha	.. ..	15,701	”
Rumiñagui	.. ..	15,603	”

And the eastern the—

Cotopaxi .. .. .	19,493	feet above the sea-level.
Cayámbi .. .. .	19,155	„ „
Antisana .. .. .	18,880	„ „
Altar .. .. .	17,735	„ „
Sangay .. .. .	17,460	„ „
Tunguragua .. .. .	16,685	„ „
Sincholagua .. .. .	16,360	„ „
Imbabura .. .. .	15,029	„ „

The western slope is drained by the rivers Guayas—the largest on the west coast of South America,—the Mira, Esmeraldas, and other minor streams, such as the Santiago, Rio Verde, and Ostiones. The eastern slope, by the Santiago and Morona, on its southern portion. But by far the most important part of this Cordillera throws off its waters by the Pastassa and Napo. Of these two, the former commences in two head-waters, the Chambo taking its source on the high land of Alausi, skirting the western slopes of the Condorasto and Altar, on a northerly course; then bending round the base of the Tunguragua, it is joined just above Baños by its companion, the Patate, which contributes the drainage of the great valley from the north in part; both then flowing together in a south-easterly direction under the name of Pastassa, through a deep valley, the steep, and in many places almost perpendicular, sides throwing off numerous torrents and rivers, of which the Topo, in conjunction with the Shuñi (Zuñag), Rio Verde, Pindo (Pintuc), and Bobonaza, are the most important, all entering it on the left bank, from the south and east of the Llanganati Mountains. From the junction of the Bobonaza, the largest tributary, the Pastassa takes a more direct southerly course up to its mouth on the north bank of the Marañon, some 2800 miles from the sea.

Following up the eastern slope of the mountains, all the streams north of the Bobonaza have their outflow into the Napo, excepting the Tigre, which has its source very much further east than the others, on the extreme out-runners of the Cordillera.

Taking them from south to north, the Curarai and its branches carry off the drainage of the north-east and north slopes of the Llanganati; the main river springs from the eastern slopes of the Cotopaxi and south-east of the Sincholagua; the Coca originates between the Antisana and Cayámbe; and the Aguarico drains the north-east slopes of the latter. From its source to the mouth of the Coca, almost as important as the main river, the Napo runs an easterly course, and thence abandons its rough, uneven, stony bed, and noisy mode of progression for a smoother and staidier, though still swift current; continuing in a south-easterly direction over a bed of sand and mud, where few small elevations of mostly red earth and loam relieve the monotony of its low even banks, discharges its waters into the Amazon, some 500 miles below the outflow of the Pastassa, after a course of 750 miles from its source on the slopes of the Cotopaxi.

The high lands and great centre valley of the Equatorial Andes, between the two ranges, enjoy a most delicious and invigorating climate, and their soil brings forth almost all the vegetable productions of the temperate zones. It is only upon these elevated regions that industry has found any development in the Republic, chiefly in the neighbourhood of Quito, Cuenca, Riobamba, Latacunga, Ambato, and Ibarra; the two former towns of great historical interest, as the homes of the Quito kings and the Incas, and all the others connected in our minds with fearful earthquakes, and volcanic phenomena of great magnitude. Commencing from the north, these towns stand upon the following elevations:—

Ibarra .. ..	7688 feet, with a mean temperature of 60·8 Fahr.
Quito .. ..	9348                   "                   "                   55·7 "
Latacunga .. ..	9187                   "                   "                   57·5 "
Ambato .. ..	8554                   "                   "                   59·4 "
Riobamba .. ..	9148                   "                   "                   56·6 "
Cuenca .. ..	8469                   "                   "                   58·3 "

Thus the average elevation of the chief towns in the valley is 8732 feet, and its mean average temperature 58° Fahr.

On the western lowlands, intermingled with the artificial clearings in the forests and along the river-banks for the cultivation of cocoa, coffee, cotton, sugar-cane, fruits, and pasture, we find natural *sabáñas*; and in the dry season, from about June to January, all is bare and parched, owing to the total want of rain, with the exception of some half-dozen showers falling generally about October; though in a small locality near to the never-watered North Peruvian desert, hardly a dry day is known in the year.

On the eastern slope, however, all this is changed; the rainy season may be said to last from the commencement to the end of the year. The heaviest rains, with snow and thaws on the mountains, and the consequent flooding of the rivers, occur from about March to August.

Here no "*sabáñas*," or open plains, are to be found; all is covered by the same dense, impenetrable forest, where the vegetable kingdom truly lives a life of struggle for existence, the fittest living and thriving upon the decay and death of the weaker and decrepit. Here the trade-winds, which blow up the great Amazon Valley loaded with the moisture of the Atlantic, are continually discharging the same upon the slope of the giant wall which arrests their advance; and though at times rain may not fall for two or three weeks, the soil and all the lower vegetation are scarcely the less saturated, for the sun can never penetrate and cheer the gloom of the canopy Nature has placed over them.

Although the greater part of the moisture from the Atlantic is condensed upon the valley of the Amazon, and especially upon the eastern slope of the Andes, some of it, and I may say a considerable portion, is concentrated in clouds, by the natural laws of attraction, round the tops of the great peaks, which are seldom seen unshrouded. Upon these summits, again, much moisture is deposited in the form of snow, but yet part escapes their attractive hold and finds its way occasionally to the western side, where its remaining humidity falls in the shape of rain on to the lowlands and slopes, near the borders of the Pacific.

The great valley between the two ranges is practically accessible from the west, first, by the Sierra del Azuay to Cuenca; secondly, by the valley of the Guayas over an outlying ridge, or by the valley of its tributary, the Yaguáchi, to the valley of Chimbo, whence three passes are available. One, the Arenal, over the south-east slope of the Chimborazo; another, the Puyal; and lastly, the Tachuelo to Cajabamba; the two latter to the southward of the former, all reaching an elevation of about 14,000 feet above the sea-level, *i. e.*, some 1000 to 1500 feet below the snow-line. The main road from Guayaquil to the capital passes over the Arenal, though a railroad is now in construction by the Yaguáchi Valley to Sibambe.

After leaving the low Guayaquil River Valley (in June 1875, on my journey across the continent), the road began to rise along the valley of a mountain-torrent, in many parts defiling along the upper edge of the stream, and frequently crossing it, each descent or ascent to or from its bed being little short of perpendicular. Imagine the bed of a torrent composed of large stones and boulders, with a mixture of broken trees and branches, filled out evenly with soft mud, so that its surface *appears* almost level, and some

idea of a great part of this day's road will be formed, it being utterly incredible how horses, and especially with heavy loads, can pass it—the main highway of the country,—the fearful abandon of which is typical of the state of affairs in general in this despotic Republic. Imposing natural masonry, if so it may be called, is also to be seen along this road, the bed of the torrent being worn perpendicularly down through a more extensive bed of stones and boulders, which, as one passes along its base, appears to form an immense ancient stone wall. The scenery is most enchanting, and the vegetation equally so. Tree-ferns, bijao, mosses, and finer ferns, orchids, &c., being profusely intermingled with the higher woods and other parasites and creepers.

Passing through Balzapamba, an indescribably filthy collection of huts and a main halting-place on the way, the road continues zigzag and round the mountains, which are very precipitous.

The butterflies are innumerable, and their variety very great. As the elevation becomes greater the vegetation also begins to change; the tropical plants and flowers, bamboo-cane, &c., disappearing, and fuchsias, a species of rhododendron, calceolaria, heliotrope, and such like, taking their place. These also begin to get scarce towards the top of the ridge, where the air is extremely cold, damp, and misty; but the disagreeable temperature is soon left behind, upon slipping and tumbling down a shockingly bad path, composed chiefly of quagmires, to San José de Chimbo; the latter part, however, adorned and scented like a garden, through a most lovely country.

The views from "el Chucho," the highest point of the pass across the outlying western ridge, are most grand, the distant mountains below looking in some parts like long coast-lines, and the clouds still below them forming a sea.

The valley of Chimbo is picturesque and cultivated all over with lucerne, wheat, Indian corn, and beans. The village is rather neat, and bears some comparison with many small European villages, especially in the Rhine province; its streets are paved, and in much better order than those of Guayaquil. The people, as in all the interior, are of very dirty habits. One man, upon my stating that I wished to go to the nearest stream (as no washing-basins are to be found) to wash myself, was very much astonished, and on my inquiring whether they never washed there, he replied, "Never, as it makes one ill!" This was said in a warning tone to us so that we might not wilfully ruin our health, but we disregarded the admonition, and afforded our acquaintance and his friends, called together for the purpose of observing us, great wonder and amusement by washing in the icy-cold brook, a performance they had evidently never witnessed before. We were from that moment looked upon with considerable interest, no doubt as "peculiar people!"

An hour and a half distant from San José, by a fair, though unfrequented, path through fields of corn and grass most of the way, is the little village of Santiago. Thence, leaving the Chimbo Valley to cross the main western chain, our road lay at first through grass fields and cultivated hills, a continual precipitous ascent; until, after descending a gully and crossing a torrent, it began to be less agreeable, continuing to mount through damp, mossy woods, with overhanging bushes which interfered considerably with our progress. As we rose, the damp, parasitic, woody vegetation gave way to Páramo grass, heaths, and a few hardy ferns and gorse-like plants, and we at last really commenced to go through the little frequented Tachuelo Pass, firstly winding in and out the gullies, until at last we crossed the main torrent. Now we defiled along a ledge of rocks and stones on the right bank of the torrent, to all appearance, and in reality to a calm judgment, impassable for a goat; yet we had to pass it on horseback, slipping, jumping, and struggling in all



manner of contortions to prevent our legs and feet from getting jammed against the rocks. At last we came to the head of the torrent, and recrossing the same, now very small, passed through some swampy grass-land (Páramo-grass now being the only vegetation), and reached the end of the western side of the pass. Here a ridge, as it were, a wall of solid bare rock, crosses it entirely, and only in the centre at the top is a small breach, access to which is attained by a break-neck path winding over loose porphyry débris. The first and second parts of the descent on the eastern side correspond exactly in character to the western. The breach, or "window," as the natives call it, is very little short of 14,000 feet above the sea-level. Toiling on and on through the eastern side of the pass, we arrived at length, after nightfall, at Cajabamba (at half-past eight at night), and had to sleep in our wet garments, on wet ponchos, covered with ditto, on the damp earth-floor of a miserable dwelling, the night being very cold and wet.

Cajabamba is the old Riobamba, and still shows many signs of the larger town which formerly occupied its place, and which was the scene of some of the most terrible convulsions of the earth ever witnessed in history. The large landslide, or falling down of a large piece of the mountain on the side of which it stands, is still plainly visible. From the old town to Riobamba we passed down a ravine cut away by a torrent through an immense depth of volcanic tuff and scoriae, showing the enormous quantity of matter that must have been ejected by the giant volcanoes in times gone by.

Riobamba lies in a sand valley or plain of the great centre highland surrounded by mountains—the Chimborazo, Carguairazo, Tunguragua, and Altar, all being visible from its "plaza," and those who know these names can well imagine the unequalled grandeur of such a scene.

Leaving this town, rendered doubly famous by Humboldt, we continued during fully three hours traversing its plain of volcanic sand, with no vegetation but very low Indian corn, not more than one to one and a half feet high, and cabulla or the Mexican aloe, here a thriving plant, and every portion of which, root, leaves, stalk, and flowers, is turned to useful account by the natives. Upon reaching the higher part of the plain we followed a path downwards towards the Chambo, and came to the bridge at Penipe, now feeling as if we were really crossing the continent, as we considered that the river we were to pass over runs directly into the Atlantic, though only after a course of some 3500 miles.

Near the village of Penipe some lead graphite and a vein of fine anthracite have been discovered.

Hence our road lay along the ledge of the Chambo Valley, the river flowing between enormously steep mountains on either side. At about eleven o'clock that morning we found our arrieros (muleteers), whom we had sent off before our departure from Penipe, standing at the side of a torrent generally easy to pass, but now swollen with the heavy rains above, and carrying down large stones in its course. We waited patiently for about an hour and a half, and then at last attempted crossing, as the water showed no signs of decreasing, and reached the other side in safety. This, however, did not reanimate our men to follow our example, they remarking that they were not "made" (hechos) "for crossing that torrent."

It is an astonishing trait in the character of all these common Serranos of Ecuador how utterly shameless they are of showing fear; and where their dull perceptions allow this feeling to get into their heads it is impossible to make them get over it, either by persuasion, shame, or practical illustration of the absence of danger. I determined not to wait until they crossed, so continued my road alone, leaving my travelling companion, Mr. Sarkady, the job of trying to get the remainder of our train across the stream, whilst I went forward to prepare for our reception at Baños.

To begin with, I lost my way, but was soon put right again, and lost little by it. I then crossed another much larger torrent, with a very devil's bridge over it, at a great height, and very shaky, its construction consisting of logs of wood laid on the ledge, cut out of the water-worn rocky hill-side, and projecting beyond its limits. On the other side is a similar construction, stones being placed upon the ends of these logs to prevent their overbalancing with the weight of the bridge proper, which is thrown across from the outer extremities of the approaches on either side. I saw no remedy but to cross this, and therefore did so without much hesitation, and, fortunately, without the collapse that the frail construction seemed to give reason to expect. A difficult ascent brought me on to a path leading up and down hill, and in and out the "quebradas," or breaks of the main valley, where a good deal of that most annoying of all riding fell to my lot, namely, up and down steep "cuestas," pouring with rain, and the overhanging wood and bushes trying to scratch my face and tear off my hat and poncho. Up to three o'clock nothing was to be seen on account of the rain, when quite suddenly a gust of wind cleared away the clouds, and the precipitous mountains on the other side of the river were again visible. With intervals of rain and sunshine, I continued until after passing the first narrows of the river, which continue all along the base of the Tunguragua, where it runs through a bed of hard lava, in many places not more than 20 feet broad, the sides cut into this iron material and often overhanging, with intermittent falls and rapids, all, owing to their wonderful and rare bed, very unique and beautiful.

Upon my reaching the mouth of the Patate the rain came down in torrents, and, it being already five o'clock, I began to despair of getting to Baños at all, not knowing if I was on the right road or not.

Opposite the confluence of the Patate and Chambo, which from this point flow on under the name of Pastassa, is the most wonderful conglomeration of broken blocks of lava, scoria, and stones, all mixed in the roughest confusion. No large streams of lava, mountains and valleys of tuff, and volcanic sand and ashes, have ever given me such a vivid impression of the terrific destructive power of a large volcano. These lavas have the appearance, to use a homely simile, of the roughest fernery rock-work, only far more irregular and on a giant scale, all shot into a heap. The path had to be picked through its midst, and a quarter of an hour goes in winding one's way through its rude blocks.

After this is a flat piece of scrub-land, and then again the valley narrows, and the track winds along the ledge of the hills, and in and out the gullies. In rounding a sharp, steep ledge, high above the river, my saddle, in the horse's strenuous efforts to get up without sliding backwards, slipped right over his haunches, and subsequently by his kicks and plunges was sent flying up into the air, together with the saddle-bags and other paraphernalia, part of them falling down the precipice to the foaming waters.

The furious charger escaped following them by a hair's-breadth; his hind legs actually vanished over the side, but with a supernatural effort he righted himself again on to the path, and immediately stood still as a lamb from fright at his miraculous deliverance.

I re-adjusted the wrecks, and now found myself in an even more unpleasant position than before, having to continue on foot leading my horse, night having come on and heavy rain pouring down, the way quite unknown to me. I stumbled along through mud, puddles, rocks, and stones, and through a torrent, the depth of which I could not ascertain until I cautiously entered it, and emerged on the other side, where, however, I could find no ascent, until after looking with my face near the ground and feeling my way, I found a gap in the bushes and ascended. A ledge so narrow that only one person could pass at a time, as I afterwards found out by daylight, brought me to a house, where

I was informed that I had reached Baños at last. After begging shelter for the night in several houses without avail, I found the temporary residence of Mr. Lizaraburu, brother of the Bishop of Guayaquil, who received me most kindly, and gave me a bed for the night, where I forgot the toils of the day, awaking only now and then at hearing the cannonading of stones and débris which are incessantly detaching themselves from the mountains on the left bank of the Pastassa, and have been thus crumbling away for years. Once in the night a tremendous shock startled me. This proved to be a large landslide out of the pendant side of the mountain just behind the village, about a quarter of a mile distant, loosened by the heavy rainfall.

The next day I engaged a "Comerciante del Oriente" (merchant from the East), as they are called, who has lived seven years on the Napo, to be our foreman and interpreter hence to the borders of that river. His occupation, like that of almost all the rest of his class, is gone, as trading with the Indians is now forbidden, Canelos, Macas, Sarayacu, Curarai, and the Upper Napo, all being placed under the unlimited authority of the Jesuits, who have some six missionaries there. With the new "major-domo" I made a trip to Peliléo on the Patate, to engage the necessary men for carrying our baggage to the Upper Curarai from Santa Inez, where they were to meet us three weeks later.

Returning from Peliléo down the Patate Valley I saw the Tunguragua straight before me, and on its right, further back, the Candelaria, a long line of snow-capped mountains, which must culminate in the Altar. The view we got of the former mountain from the opposite side of the Chambo was unequalled, we being about 1500 feet above its base, with the river between us, and having a perfect view of its entire conical shape, from the unclouded summit of pure white right down to the extremities of its base, not a particle being hidden from our sight by any unevenness of the ground.

Baños lies on the right bank of the Pastassa, at an elevation of 5904 feet above the sea-level, enjoying the agreeable mean temperature of 63½° Fahr. in a kind of cauldron enclosed by the steepest mountains, the only outlets being the narrow valleys of the river. At night it has entirely the appearance of one's being in a large well or pit, surrounded by high dark walls, with the heavens only visible high above one's head. Just behind the village the hills retire from the river, and so leave a little level ground, which is used for the plantation of sugar-cane. This, notwithstanding the rather low temperature, thrives, as it is irrigated by the warm water from several springs issuing from the back hills, whence also a pretty cascade falls.

From Baños we started on foot with sixteen men to carry our necessary baggage to Santa Inez, leaving our "Eastern Merchant" behind to come forward later on with the peons engaged at Peliléo. How these men got through the fearful roads we met with, having a load of 80 lbs. on their backs each, is perfectly marvellous. Occasionally we came across land-slips, which the recent heavy rains had caused, and which had carried away all the loose vegetable earth from the mountain-side, with trees and everything upon it, all hurled down to the river below; and as the track was also obliterated in such places, passing them was very difficult over a footing of steep, slippery, and muddy rock. Serious obstructions were also formed by large fallen trees across our path, to be scrambled over as best possible.

All the time we were following the Pastassa Valley, skirting along the hill-sides of the left bank, from the gulleys of which numbers of beautiful cascades fall to swell its waters. In one place, Antumbós, four large ones are to be seen close together.

The finest sight, however, is the Fall of Agoyán. The river is here compressed into a narrow rock-bed, and falls through a crevice in this of only about 15 feet in width, a little towards the left bank, over 100 feet down below. The spray, which is thrown up in jets, in form as I have only seen

in artificial rain of fire, has worn or scooped out an enormous conchoidal cavity, which goes under the side of the Fall a little towards the left bank, and the darkness of which contrasts prettily with the whiteness of the spray and the foaming water.

In leaving Baños we had left the last civilised (*sic*) settlement of note, and, following the river downwards, we only find the haciendas of sugar-cane, all used for the distillation of spirit: Aгойán, Antumbós, Rioverde (abandoned), Machai, Mapóto, and Santa Inez. After leaving the latter, downwards towards the Marañon no habitations but of Jívaros and other pure Indians can be found.

The buildings of Santa Inez, a name since the last few years well known to entomologists, stand in a portion of an ancient bed of the Pastassa. The river here seems always to have been retiring towards its right bank, for, commencing on the left about a quarter of a mile behind the houses, we find a water-worn embankment, some 50 feet high, covered with thick wood at the top; next, receding to the right, is about a quarter of a mile of plain, composed of shingle, but covered with a layer of vegetable earth, now under cultivation. Upon this the houses stand.

Passing further to the right we come to another perpendicularly worn bank of shingle about 20 feet in height, and descending this again to a plain of shingle, already with high wood on its more elevated portions, and low kind of willow bushes on the remainder. Beyond this flows the river, when low, some 10 to 12 feet below, held in its bed on the other side by precipitous rocky hills. About half a mile above Santa Inez—the first high bank—and the hills above it, close in right up to the river, and again a short distance higher up the bed opens at Mapóto, almost all the “haciendas” named being situated similarly, in lateral extensions in the valley or ancient bed of the river.

Down below Santa Inez the bed also closes gradually. The second bank enumerated runs close up to the stream, and a little beyond the first high one also approaches, so that just before reaching the Topo, about 6 miles distant, but one steep hill forms the left bank. The formation of the ground clearly denotes the recedence of the river not to have been gradual, but to have taken place after sudden and powerful floods, a theory quite compatible with the similar results produced by the great floodings (*reventazones*) of some of these rivers at the present day.

When we approached the Topo with our entire train to cross it, we found the water much higher than we had seen it the previous week, and by the ordinary method of throwing a bridge of logs from rock to rock we should not have been able to pass; but fortunately a “taravita” (a tight rope) had been left across it for our use.

A few words must be said regarding the Topo, as it is the most notorious affluent of the Upper Pastassa, and has caused trouble and danger to many. It forms the most dreaded barrier between the east and west, and is truly the Rubicon of Ecuador for travellers to the “Provincia del Oriente.” For the Napo, and even for Canelos, traders mostly descend *viâ* Quito and Papallacta, the only other available route, solely to avoid this torrent, though on that road is the Cosanza, not much less to be feared. On the Topo the rise of the waters is so sudden, that small parties of traders with their peons have been separated whilst crossing it, and sometimes imprisoned between it and another torrent, running into it just before its fall into the Pastassa, the Shuñi (or Zuiñag), for two and three weeks without possibility of effecting an exit either way.

It rushes, or rather springs, down its bed at a frightful pace; and as this is filled with unevenly-dispersed enormous boulders and rocks in mid-stream, and in all directions, besides its irregular perpendicular banks of similar solid material, the rush of its waters can be imagined when they rise so as to almost cover the highest of the rocks in its centre, passing at a rate of some 20 miles

an hour, and dashing their spray and foam thick and high up into the air. Of course the thought of crossing such a rapid in any way but quite out of reach of its waters could not be entertained. I had heard much of it, but my imagination had never pictured it to me so awe-striking as it appeared the next morning, a wet stormy night having been passed rather miserably, as our tent was not well spread. The waters, to our astonishment, had risen over six feet above their high level the day before, and much of the spray, and even the head of crests thrown up from one boulder, reached our suspension bridge high above, so that crossing was of course rendered impossible, as the elasticity of the imperfectly-stretched rope, with the weight of a man in its centre, would have lowered him right into the thick of the crests as they dashed past. During the miserable rainy day we passed on the right bank, anxiously awaiting a fall of the tide, I had ample time to call to mind the warnings of the President, the brave and talented Garcia Moreno, and the illustrious Bishop of Guayaquil, as to the difficulties I might encounter in this season of the "nevadas." However, these were again forgotten for the time the next morning, when we found the river fallen 6 feet, to the level we had found it on the evening of our arrival.

This copious precipitation of water down the rivers of the eastern slopes of the Equatorial Andes is owing principally to their precipitous formation, and the presence of extensive huge lifts high up, which fill with snow, and in the season of heavy storms and thaws are all at once voided, thus descending like an avalanche promptly liquefied by the higher temperature it encounters, and the abundant admixture of the rain accruing from every rent and slope.

The greatest and most devastating floods have been caused on the occasion of some of the great volcanic eruptions, the heat developed in the cone suddenly melting huge masses of the snow upon its summit, causing inundation of all the land below, as especially has been the case on the gigantic Cótopaxi.

By the time we were all safely across the Topo, and had reached the Shuñi, it was already too late to pass that river before dark, so we settled again for the night on its right bank, thinking how fortunate we had been to have had a "taravita" to cross the Topo, as without one we might have been detained for a long time in such an unreasonable time of the year.

As during all our journey on foot to the Napo every day was conducted under more or less similar arrangements, it will be perhaps not amiss to give an idea of each day's division of labours.

As soon as day began to break I called my servant to get up and make the fire for breakfast-cooking, and in the meantime rose myself and placed the necessary rice, yuca, potatoes or plantains, whichever we possessed, to boil with meat when we had any.

After this we generally ate a little plain boiled sago or a cup of chocolate, using all the provisions very sparingly, in case of unforeseen delays occurring later on. The meals of our peons consisted solely in "mashka" (a coarse barley-flour), and pea-flour, nearly always eaten in its crude state; just a few handfuls thrown dexterously into the mouth three or four times a day at the halting places for five minutes' rest. On the road they eat absolutely nothing else, and upon such short rations do their work wonderfully, like horses impatient to finish their task and get into the stable, and are untirable; but when well, or rather not so badly fed, they get lazy and sluggish.

Breakfast towards its end, tents, cooking utensils, camp beds, &c., were repacked, and the march resumed at a good round pace.

Our halting-time for the day varied much, according to our inclination. Sometimes the day's walking was finished at four, and even three o'clock, when any specially attractive spot was found for a resting-place. At other times we continued until almost dark, when no desirable one presented itself,

or when no good stream of water was at hand, which latter, however, only once occurred. Upon halting for the day, axes and machetes were immediately brought into requisition for clearing a space for the tent, and large palm-leaves cut for its flooring, with a good stock of firewood.

Our encampment consisted of two tents, and three or four "ranchos" for the peons, constructed of palm-leaves bound on to a light frame, like a single sloped shed-roof. At night this presented a very pretty and picturesque spectacle, and the bright fires before each construction gave a very cheerful contrast to the dark, impenetrable, and wet forest.

Very soon after dark all the human voices were hushed around in slumber, I still generally remaining quietly smoking by the fire, arranging and putting away the butterflies captured during the day, making entries in my note-book, or reading Shakespeare by the light of a lantern. These moments at night were most enjoyable, and will leave a lasting impression upon my memory. The impenetrable gloom of the virgin forest; the fantastic shapes of the nearer trees, palms and thick heavy creepers, when lighted up by the bright but fading fires at small distances and in different directions, shining like sparks through the thick foliage; the hum and buzzing of myriads of insects; the superlatively mournful song of the night birds—one a perfect minor scale of five notes; the mellow clucking of a species of opossum; the deep suppressed whistle and see-saw humming of the jaguar; and to this added the manifold cries of the frogs, which vary from high-pitched screeches and human-like screams to the low hoarse bark of a huge mastiff, all tended to produce upon the mind an indescribable feeling of solitude, notwithstanding the noise they created.

The Shuñi was crossed by throwing trunks of trees across the unfordable parts, and then the wearying Habitagua scaled to its summit, 2000 feet above its western base, and 2400 above the eastern. Upon this eminence we continued along a ridge a short distance, and got to the south-eastern side of the mountain, where we rested to feast our eyes upon the magnificent view stretched before us. To an immense distance, until entirely lost in the haze, flowed the Pastassa, winding like a silver thread through the green velvet of the thick vegetation, or bordered by hills and undulations all dressed in the same verdure. It is said by the natives that from this spot the hills of Bolivia can be seen, but this is of course an exaggeration of the immensity of the view.

After the Habitagua a few minor hills follow, and we at length descended on to the level soil of Barrancas, running along the left bank of the main river, a very pleasant change after so many steep ascents and descents. The ground was very damp, although according to the opinion of all our men, it could not have rained for a couple of weeks, an extraordinary thing for this time of year. All this alluvial plain in wet weather is a fearful swamp, and in the driest time always abounds in "cienegas," or bogs, patches of mud of great depth, in which the whole body would sink, were it not for sticks thrown across them, and traversed like floating bridges. In many places these logs or long stems thrown on to the morass are just under water, or slightly buried in the upper surface of the mud, so that great caution is necessary in assuring each footstep on the hidden support.

Palms were here very plentiful, especially the Tarapoto, which supplies an agreeable vegetable from the inside tender shoot at the centre of its crown, and the fresh trails of numberless tapirs, jaguars, peccaries, and deer were everywhere visible.

At Barrancas I first heard the song of the "flautero," the most beautiful songster that I know among birds. His song is not quite the same in all individuals, but may be likened in tone to the most mellow, sweet-sounding flute, and the musical correctness of all his notes is astonishing, and makes

one imagine the whistle to be human. Upon one occasion, after this, I was utterly deceived, being alone in the woods, and looked for the person I thought must be whistling so charmingly quite close to me, but I suddenly recollected the "flauto," or "flute bird," and stopped to listen to his performance actually ending on the key-note. He is a very insignificant little greyish-coloured bird, and almost invariably dies in captivity. He dances and performs strange antics before the female during his song.

A steady day's work brought us from Barrancas to a clearing in the wood—quite a relief after such a length of time under the heavy foliage—where stood the houses and plantations of some Jívaros near the little river Pindo (or Pintuc), which with the waters of the Puyo flows into the Pastassa a little further down.

The tribe (or tribes) of Jívaros is a very large one, and one of the most independent and warlike in South America. They withstood the attacks alike of the Incas and the Spaniards, and burnt the once-famed and somewhat populous settlement of the latter, "Sevilla de Oro," killing all its male inhabitants; and even to this day they maintain the most thorough independence. The Missions in Macas and Gualaquiza have produced as yet no practical results and obtained no authority over them. A Jesuit padre, who had resided three years amongst them, informed me that he found it impossible to make any progress with them, and more than once his life was threatened. During the mentioned period of his labours they murdered twenty-nine whites (traders, &c.) in the neighbourhood of Gualaquiza.

They speak the Jívoro language, and occupy the country generally from the Upper Pastassa to the Santiago—both rivers included—down to the Pongo de Manseriche on the Marañon; most of those, however, at Píntuc understand Quichua.

After a short sojourn with our hospitable entertainers, though not disinterested ones I am sorry to have to record, we crossed the Pintuc at a rather deep ford some two hours from the settlement, and now, leaving the Pastassa banks for an almost due westerly course, plodded our way on still through the same jungle, only over more gentle slopes compared with what had preceded, until, after two days' journey, we reached the summit of one of those most curious of modern geological formations called "Cuchillas" (knives), on account of the sharpness of their upturned blades. The Cuchilla is a ridge, generally running for a considerable distance, sometimes 10, and even 15 miles uninterruptedly, with an elevation as great as 500 feet from the base. On one side they are generally almost perpendicular, and on the other descend at a sharp angle. The most wonderful part, however, of their construction is their composition, which consists of loose vegetable earth and loam. It was to me a never-ceasing marvel how these "blades" are held aloft solely by the support of the entangled roots and vegetation with which they are covered.

The formation of "Cuchillas" has been to me a matter of great interest. They are probably the firmest portions of the loose vegetable earth left by the denuding waters, and their very substance has doubtless been, in great part at least, stripped off the more elevated portions of the Andes, which by this continual process of denudation have been tending to increase their steepness above and reduce it at the base by filling up the abruptness of the lower descent.

They are the remaining ridges, bound together by friendly roots, left by the streams which have transferred the remainder into the valley of the Amazon, whence it is slowly but surely reaching its ultimate destination, the Ocean, perhaps again to raise its head above the waters and once more form dry land; and the selfsame waters that denude, tear down and carry off the solid matter of which the mountains are formed, after depositing it in the

ocean, are again drawn up to the clouds and poured upon the slopes and summits to resume their work of levelling and distribution of the soil over and over again.

All the territory I traversed between the Pastassa and Napo, at the base of the Cordillera, is crossed by Cuchillas, and it would be interesting to know if they extend further north and south, or are only a feature of this portion of the Andes.

Leaving our elevation by a sudden descent, we came to a pretty little stream, the Tinguisa, along the coarse and uncovered shingle banks of which we walked until it brought us into the Bobonaza, now a little swollen by the rains, so that great precaution was necessary in crossing it. Landed on its left bank, we ascended a steep eminence, and came suddenly up to the village of Canelos. Here the expectations of months were dashed to the ground at a glance. Our guides and peons had spoken to us of Canelos as of a place where we could procure almost anything we required, in fact as an important settlement, which quite coincided with our impression in its regard—the place where the first great Spanish conquerors had found the prized Canela, whence it derived its name; but notwithstanding the very large deductions we had made from the reports we had heard, we were much disappointed at its utterly deserted aspect. However, we were too unsophisticated in Indian life at a first glance to see far, for by-and-bye numbers of Indians presented themselves with their families—whence we knew not—to bring us their offerings of plantains, yuca and chicha, in expectation of return, or as they term it, as an “invitation” to us to *give them* knives, needles, thread and cotton cloth, with ornaments in shape of beads and small looking-glasses. Canelos has some eighteen or twenty houses, mostly hidden from one another in the bush, which will probably represent about 150 to 200 individuals, men, women and children, where at first we had detected none.

We made a pleasant stay of ten days and saw much of the Indians and their interesting habits. One of them, a sturdy old fellow, was, of the many I have seen, the most desirous of knowledge, and the most intelligent.

To his repeated questionings, I explained to him how far away my country was; how on foot and in canoe—the only methods of progression known to him—it would take him ten moons to reach it, were it indeed at all possible; how many of its villages contained each more men than all the tribes he knew put together; how knives, axes, beads, lienzo, guns and all such things were to be had there in the greatest profusion, and that even such of these articles as they possessed were made in my country. And I further explained to him, that there were no jaguars or snakes to harm one's dogs and children, but only animals useful to man, and that served him for food. He must have thought it a paradise! He also made anxious inquiries regarding the rotundity of the earth, a new theory to him; and the seriousness and earnestness with which he listened to my explanations amused and interested me deeply.

Leaving one of our peons behind convalescent from an attack of what they call “escorbúto,” a disease falling upon almost all new-comers, though fortunately not upon us, and the cure of which is as original and curious as it is painful, we left Canelos taking a northerly direction along the tops of Cuchillas and uneven ground to the river Villano, a tributary of the Curarai, so that we had reached Napo waters. We descended, walking in its bed and crossing frequently, until we came to several huts situated along the right bank as country residences of Canelos Indians, and hence on the left bank of the river a little further inland we came to a torrent, falling into it lower down, the Chitáta, which we followed up-stream partly in the water and the dry portions of its rough bed, and occasionally cutting off sharp curves by going through the woods, until almost reaching its source high up. Here we left



the torrent and continued along a very narrow Cuchilla, rising gradually on its blade and then descending rapidly to one of the headwaters of the Curarai, here a very small torrent. This was followed down in its bed like the Villano, and forded no less than thirty-three times before reaching the village of Curarai. The river is formed by three head-waters from the outermost slopes of the north-east of the Llanganati mountains, and on existing maps is invariably placed as proceeding from too far west. After receiving the waters of the Villano, Nushinu, Supinu, Nugánu, Pundinu, and others unknown, it empties itself into the Napo on the right bank.

At the village we made some stay, and our peons returned to Peliléo from here, so that upon again starting forward we were accompanied by only pure Indians, besides our major-domo and boys.

Still always penetrating the boundless forest, we came to Jándiyácu, and thence up a long ascent and some narrow Cuchillas until the Nushinu was reached; a lovely river falling into the Curarai on its left bank. From the point to which we descended a cut through the woods brought us to a beautiful broad sandbank further down its course.

This was a most attractive spot. Behind us was the thick forest, lined outside its border with dead trees and drift-wood on the shining sand; before us the clean bank and the clear limpid stream flowing past towards our right as we faced it, where it came to a more rocky and shallower bed, and rushed down sparkling over the stones against a hard bank, covered with mosses and ferns, which gently guided its course round to the left and out of our sight. On the steep bank opposite us was again the primeval forest, adorned with graceful palms and bamboo, and on our left the glittering river coming towards us. The butterflies on the sands were so numerous and fearless, that we quietly knelt down and took them with our fingers.

After the Nushinu came a considerable ascent, only scaled to be descended again to the foot of another mountain, the Sotano, happily the last before the Napo.

The declivity from the Sotano is along a very narrow Cuchilla, and on one of the highest parts of its blade a tremendous land-slip had taken place on the steeper side, almost perpendicular before. Now it was overhanging, and not more than 2 feet broad at the top, making the view from such a frail summit on to the devastation of shattered trees and earth below imposing in the highest degree.

At the north-east base of the mountain we continued walking for about an hour down the Huáscayácu, and then over level ground to the Cósano River, where the last night was spent. The next morning's work, as frequently before, commenced by crossing the river on whose banks we had slept; so that, as usual, we started wet through. Two hours' walking brought us to the banks of the Arajuno, which flows into the Napo just below Aguano. It was too deep and broad to cross with any dress or baggage, so we sent two of our Indians to fetch a canoe from Aguano. Having crossed by this means, we continued walking in the water with the canoe containing our baggage through a small creek, which breaks from the Napo into the Arajuno when the former is swollen—rather an unfrequent occurrence to find the waters of a main river flowing into its tributary—and this brought us out on to the Napo exactly opposite Aguano; thus completing our journey from Baños in eighteen days' actual walking, without counting our various stays in Santa Inez, Pintuc, Canelos, and Curarai.

The Napo at Aguano is broader than the Thames at London Bridge, even when not flooded, though three weeks' journey from its outflow in the Marañon, and about 3100 miles from the ocean. This fact gave us the first true impression of the immensity of the Amazonian river-system, especially when we considered that the Napo is one of its comparatively insignificant tributaries.

The whole scene looked so open and grand that we drew a deep breath of relief to find ourselves again under the clear heavens, and free from the oppressiveness of the dark, damp woods.

The little village of Aguano lay right before us on the left bank, situated upon a high red-clay bluff; and on our arrival we found, to our great disappointment, that all the Indians were taking their departure, as the small-pox had made its appearance at a village above, so that the next day all had fled, and we were doomed to pass a month and a half with many difficulties and vicissitudes, awaiting means and men to enable us to undertake the journey down to the Marañon.

Our dwelling was the deserted hut of an Indian, and stood about twenty yards from the river's edge, which at this point consisted of a steep bank of some thirty-five to forty feet in height (at low water), and composed of successive strata of vegetable earth, red earthy-clay, shingle, lignite, and decayed wood, and, lastly, fine dense white clay. From this high bank the view was very good. The majestic river, as it flowed down from above—parted by two verdant islets—came rushing through three distinct channels, the streams from which united their power and direction against the worn side of a rocky hill just above the village, whence they were thrown back in spinning eddies into a single broad channel in front of us, their main strength resolutely continuing to press and grind against our bank, which down-stream sloped from a steep bluff into a gentle sandy shore. Following this a little way, the stream was cut off by a broad bank of coarse shingle and large waterworn stones, which stretched half-way over the river to an island in its centre, conquering the pressing waters, with only a small overflow, and rolling them off to the right bank where they immediately afterwards again parted, spreading through various cross channels back to the left bank; the remaining branch on the right taking up the addition of the Arajúno's waters on its way.

On very clear mornings and evenings, beyond the first black line of vegetation forming our usual western horizon rose another straight, dark-green terrace; above this, another higher line, grey with the distance; and topping all these well-defined giant steps, a long array of streaked white, on which stood in proud eminence the immaculate peaks of Cotopaxi, Antisana, and Saraguro high in the heavens.

How sublimely suggestive were the shades of this ladder to the skies; at each step higher and nearer heavenward, all becoming lighter and fairer, until at last against the golden clouds, enveloped in the dazzling atmosphere of the setting sun, these emblems of majesty and never-changing spotless purity were reached!

## II.—ASCENT OF THE RIVER PUTUMAYO (Iça), WITH A VIEW TO STEAM NAVIGATION.

This river has long been one of the most unfrequented of the Amazonian system, and though of important dimensions, is, even in name, to the general public utterly unknown. No traveller seems to have followed its course, nor naturalist to have explored its fauna and flora; and with the exception of some Jesuit missionaries many years ago, and a few traders in recent years, no civilised beings had navigated its virgin waters until recently, when some energetic Columbians of Popayan, seeing that the costly and arduous route across the mountains to the Pacific might be obviated by a much easier and more practicable one for the export of the natural products of the eastern slopes of the Andes in the province of Pasto, and mindful of the impetus to commerce, and its civilising influences that might accrue by a direct connection of the industrial and agricultural highlands with the scantily populated

Amazon valley, and thence with the outer world, concluded arrangements with the Brazilian Government, by which they obtained a right of export of their produce and merchandise through Brazil free of all duties.

One of them, the chief promoter of this promising scheme for the development of an enormous tract of untrdden country, descended the Putumayo in a canoe, accompanied by some traders and Indians; and after compacting an agreement, as stated, with the Brazilian Government, purchased a small steamer, and fitted out a complete expedition to ascend the river, the navigation of which by steam he correctly judged to be practicable.

The Government of Brazil, much interested in a favourable result for the undertaking, generously lent one of their steam gun-launches to accompany the expedition, and eventually I started in her charge to pioneer the way, and prepare wood-stations for the other boat, which was to follow a few days later. Thus fell to my lot the duty of proving the navigability of the stream, with unexceptionally favourable circumstances for the exploration of an unknown region.

Unfortunately I was deterred from making observations and investigations along the river, as I should have desired, owing to the utter inefficiency of the negro crew (who, by-the-bye, were the most consummate rascals I ever had to do with), the inexperience and unreliableness of my assistants, and the mental dulness and complete ignorance in the management of any craft larger than a canoe of my Indians. I was compelled, therefore, to be incessantly on the look-out from daybreak till dark, and frequently at night hours, the successful navigation of the launch occupying my entire attention; for steaming through strong and varied currents, intricate channels, sunken snags and huge trees, dangerous shallows, banks, and sometimes sudden tearing floods, naturally requires the most undivided attention, as a moment's neglect or inadvertence might be productive of the most serious consequences, and, perhaps, a failure in the results I felt bound to obtain.

On the eastern slopes of the Andes, between  $1^{\circ}$  and  $1\frac{1}{2}^{\circ}$  N. latitude, with the well-known volcano of Pasto towering above, all the mountain torrents which rush down the gullies of the great range are collected into the valley of the Putumayo, a small river compared with some of the other tributaries of the Amazons, but yet one which attains a length of some 1200 miles, if all its winding course be traced; the distance, as the crow flies, from its source being about 620 miles to its outflow into the Amazons, just above Santo Antonio, on the right bank, 1800 navigating miles from the Atlantic Ocean.

In ascending the Solimoes, the mouth of the Putumayo, or Iça as it is called in Brazil, has the appearance of being a continuation of the main river; which latter, just at this point, makes a sharp southerly curve, so that its real course is not apparent until the point on its south bank is rounded.

At its sources the Putumayo consists of two principal head-waters, the Putumayo itself, and, perhaps more important, or at least equal to this, the Guamués, to the southward. Following the mountain range still a little further south, we find the San Miguel River, more entitled to the name of a head-water than a tributary, since its rise is equally elevated, and even more westerly than the others; and besides, it contributes a volume of water almost as great as the main stream at their confluence.

The Putumayo runs a general south-easterly course, almost parallel to the Japurá and Napo, over a bed of shingle and rock, with high banks at first. As we proceed downwards, the banks become lower, excepting where an occasional hillock is bisected; and in many places the river opens to an enormous width, forming several channels, separated by large islands and sand or mud-banks, the shingle becoming always finer and scarcer, until at a spot above the Indian settlement of Montépa, about 900 miles from the Amazon, the last stones may be seen. Hence all is sand and fine mud; and

for almost 3000 miles not a pebble is to be found along the river, excepting perhaps an occasional one sticking to some piece of driftwood, which, when found, is preserved as a curiosity. All distances on the river refer to their navigable channels, and not to straight lines.

The average current I take to be about 3 to 3½ miles an hour, but this varies much according to its set, the width of the bed and other causes. It runs with much more force through some of the narrows. It is also greatly influenced above by the heavy rains and thaws on the mountains, and near the mouth flows freely, or is repressed, according to the fall or rise of the Solimoens.

The course is extremely tortuous, straight reaches are few, and a water horizon is nowhere to be seen on the whole river.

Sometimes it is so extended as to have the appearance of a large lake; at others, with low water and between close banks, no exit is even apparent until perhaps a narrow one is actually touched upon between a steep shore and a low sandbank. And again, at a few points the water is compressed into one deep channel, walled in by a worn hill-side, against which the current has set.

A considerable portion of the stream winds regularly in snake-like curves, the lateral reaches of which are often longer than the longitudinal ones.

The existing maps of the river are made up quite independently of surveys, and, excepting their higher and lower portions, are mere sketch-work, especially the tributaries, most of which have never been explored at all. Important ones are entirely left out, and insignificant ones prominently portrayed. Villavicencio, however, in his map of Ecuador, though very incorrect as regards the eastern side of the Andes, gives a better idea of the course of some of these rivers than other geographers. The regular snake-like form of the Napo and innumerable lagunes from which all the tributaries spring, like a row of musical notes, though probably only delineated from hearsay and guess-work, give a very fair general idea of the windings of the Putumayo, apparently so unaccountably regular, and yet, if we analyse the formation of its bed, most natural, and the inevitable tendency of swift and powerful rivers traversing an infirm soil.

The first flowing waters no doubt followed the slight depressions of the undulating ground, and very shortly, as they gained strength, more or less straightened their path, carrying away the but slightly-resisting swellings of an alluvial soil. Afterwards, wherever a little greater firmness was encountered, the stream was bent out of its steady course, and the waters forced against the opposite bank, which was thus always scooped out more and more, and a great part of the soil carried from it and placed as a rearwork to the firmer spot, so that this was daily increased by the depositing eddies as the other bank lost ground, until at length a scarcely perceptible bend was converted into a sharp curve. A single unevenness, perhaps only in the consistency of the soil, having thrown the force of the current against one bank more than another, and a curve once beginning to form, it was thence rolled over again to the other side, there to wear out the shore, and rebounding to continue from side to side, until the once straight river was brought to the state in which we now find the Putumayo.

All the inner (concave) curves of the banks rise gradually from a low recent deposit, and their vegetation is of a quite different description from the older forest on the outer (convex) curves. Thus, by the vegetation alone, a former much straighter course may be distinctly traced, and generally, at least where the river bends, the deep side is easily recognised, solely by the nature of the forest which borders it.

In some places the strong floods take a direct route over the tongues of land forming the inner curves, instead of following round the circuitous channel, and thus islands are formed and the bed of the river spread out, one part of the stream resuming its primitive, or rather previous, channel.

Most of the islands are formed in this way—gradually deposited against the shore by the eddies, and then cut off by floods, very few being created from their commencement in mid-river independent of an inner bank, and still fewer of them are original, that is to say, of equal date to the main forest.

In the formation of the bed of these rivers we have a vivid illustration of what we so frequently see in the course of human events and physical forces: how an apparently small and insignificant cause can stir a mighty force into action out of its prescribed routine, and how, when once disturbed out of its accustomed channel, a powerful stream may continue to sway here and there in utter disregard of its former tranquil progression, until perhaps a stronger influence may turn it again into its right groove.

There is a singular sameness in the appearance of the banks on the entire river; and although naturally the vegetation has the richest variety, as in the whole Amazon valley, this same profusion throughout is wearying, and productive of a strong desire that one may meet with a rough, rocky bank, an open plain, a cascade, in fact anything to vary the monotonous low banks, for such is the perversity of human nature that we desire always that which is not present. Whilst among the mountains and torrents one longs for plains and smooth rivers, and when these are reached the former are again sighed for. Nevertheless, I must confess that the endless beauty of the thick vegetation, the immense variety of palms, the graceful bamboo (always the thorny species east of the Andes, replaced by a smooth one on the western side), the wild plantain, the various ferns, and the innumerable forest trees, all intermingled with, and bound together by, an infinity of creepers, lianas, and parasites, were a continual source of admiration and enjoyment.

The principal tributaries on the right bank are the San Miguel, already mentioned, Incuissilla, Oquiri, Campúyas, Guayacurú, Yáhuas, and Utuhué: and on the left, Cocaya, Tóhalla Grande and Garaparaná; the last, from all I was able to ascertain and by the appearance of its outflow, the most important of all; and it is to be inferred, by its being the dwelling-place of Miranhas, in close connection with the Japurá, though I have not seen it marked at all on maps of that region. Its mouth is very large, situated about 20 miles below Carapaná, and has at times been mistaken for the main river, of which it appears the continuation when ascending.

Of these tributaries, the only ones at all known, besides the San Miguel, which runs within a day's foot-journey of the upper Aguarico, are the Yáhuas and Utuhué. The former has, on rare occasions, been passed by traders; and one of them informed me that 11 days' canoeing on its waters and 1½ days on foot brought him to Pebas, on the Marañon. The latter serves as a similar communication with Loreto, by which we may gather that the direction of both these streams on Ponce de Leon's map of the Cauca is entirely erroneous.

As may be supposed, the upper tributaries are of a very different description from the lower ones; the former very rapid and occasionally much flooded; the lower ones sluggish, less variable, and most of them almost black water, which, it is needless to say, the main river, as proceeding from the Cordillera direct, is not. A mountain stream, the Vermeja, entering the San Miguel from the westward near the village of the same name, when flooded, colours the whole of this river, and sometimes the Putumayo to some extent, reddish.

The Putumayo is inhabited entirely by pure Indians, of many different tribes, excepting a few individuals of mixed breeds in the uppermost villages and at the military station on the Brazilian frontier.

From the Guamués to the Cocaya the main river is inhabited by, let us call them, Macaguájes, or Píojes of the Putumayo—for they seem to have no special appellation, the former name being usually only applied to that part of the tribe occupying the Cocaya—to be distinguished from the Píojes of the Aguarico and Napo, though to my surprise, I found their language to be the

same, yet they seem to be quite ignorant of its being spoken by another large tribe elsewhere. The only other resemblance I could find opportunity to trace in their customs was the profuse drinking of Yoco at all hours, and especially at daybreak. Yoco is a liana, the bark of which is scraped off when fresh, then kneaded in water and thrown out. The water takes a yellowish-brown colour, and is then drunk in quantities of about half a pint, or rather less, at a time. It is bitter, the first flavour somewhat nauseating, but the after-taste left on the palate is not disagreeable, and it is considered very refreshing and sustaining. In the early morning the first dose is taken diluted in about a quart or more of water, and with the aid of a feather or the finger vomiting is produced. The Piojés of the Napo use it as a restorative and antisporific for the performance of their night-work and night journeys. The semi-civilised portion of this tribe occupies the villages or hamlets of San José, Cuembí, Yasotoaró, Picudos, Montépa, and Consacuntí, where they receive periodical visits from the "cura" on his baptismal and matrimonial rounds; but beyond this their Christianity does not reach, and is merely thus far accepted on sufferance, and because they partly feel that they must submit to what is imposed upon them, and partly because they think that these ceremonies make them "gentlemen" and more like white men. All the Indians of the Napo, Pastassa, and Putumayo, who have had contact with or even heard of white men and baptism, show the greatest distaste to the despicable title of "Aucas" (heathens), and invariably disclaim it for themselves, but I fear their religious zeal goes no further.

The branch of the same tribe occupying the Cocaya is called Macaguáje, as before stated. These Indians are not Christianised, nor do they speak the peculiar Spanish generally known by their less savage brethren.

The Piojé language, from what I could hear, is harsh, and the vowels generally short, the final one of a word extremely so, each syllable being uttered with almost equal accentuation, and the word winds up, as it were, with a sudden stoppage before the final vowel is fairly in the mouth, and much less out of it. It is evidently of very difficult acquisition, as amongst strangers who have lived with these Indians, and picked up other languages with ease, I did not find one who could speak or even understand it.

The San Miguel River Indians are mostly fine massive men, and speak a language of their own, but generally also understand and speak Quichua.

The next tribe is that of the "Oregones," inhabiting the banks of the main river, and some of the quebradas inland, from Yavocurú, just below Tohalla Grande, down to the Toquilla Urcu and Yacaré Cocha.

As their name implies, they have large ears, the lobes of which are bored and stretched until a small block of wood up to an inch and a half diameter can be inserted. The men are small, emaciated, and phthisical: the women very short, but almost all those I saw were stout, and to all appearance healthier and stronger than the men. The Oregón language is very agreeable to the ear, and its sounds are easily caught and repeated with precision, unlike the Piojé and Záparo tongues. The women are very talkative and merry, showing no particular shyness nor excessive curiosity, as they receive a stranger in their indoor costume, which consists solely of a mussel-shell attached to a string of small beads. Out of doors, near the river, the numberless flies compel them to cover their bodies. Their houses are practical, and differ from those of the other tribes. They are constructed as if all roof, thatched down to the ground, with a door at each end, consisting of similar material to the rest, which swings from above, so that an entrance or exit is made by pushing and passing under it, when it immediately again falls to its place. Inside all is dark until the eyes get accustomed to the change from the strong sunlight outside to a space where all light is excluded except a slight glimmering between the interstices of the thatch; but after

a short time the pupils dilate, and the interior becomes perfectly distinguishable. This state of semi-obscurity is maintained to keep out the flies (Piums), which are found here in indescribable numbers and voracity.

The Miranhas, known on the Japurá, inhabit the Garaparaná; and further down, on the right bank, are the Yahuas and Ticunas. On the left, exist the remnants of the fine and ill-fated tribes of Yuris and Pasés, all well known to travellers.

The Incuisilla, Semerí, and other tributaries, contain savages, but they have seldom been seen, and the Piojés, who are the only ones that travel down the whole length of the stream, always flee from them, if they happen to show themselves, so that nothing whatever is known in their regard.

For the voyage up the river I took in a supply of wood at the Brazilian frontier station, 150 miles from the mouth, which had been prepared by Indians, who had been sent on there in advance, and whom I then took on board. Further up, also, small supplies were obtained at two different places, already cut by previous arrangement, until we reached Carapaná, a spot so called after an Indian of that name who had formerly lived there; but lately a house had been erected on the spot and inhabited by a German, rejoicing in the name of Christopher Columbus, who, poor fellow, to crown his voluntary exile and hard life in such a pestiferous and Pium-plagued spot, had lately been murdered by two of his Indians.

Carapaná is nearly 600 miles from Santo Antonio, and had taken us 147 hours' actual steaming against the current, anchoring, of course, at night. Here we found a little wood already cut, so I only remained 2½ days, taking in a full complement of fuel, which was always calculated to last about four days, and leaving over 3200 logs in readiness for the steamer which was probably following us.

From Carapaná upwards we were entirely on our own resources, and I had instructions to fix three stations at equal distances between this and the first habitations of the Christianised Indians, Consacuntí, and to cut and stack at each of them a supply of fire-wood, clearing the bank so that a steamer might get alongside, and leaving the spot conspicuously marked so that it should not be passed unobserved. Now, it was no easy matter to divide a route into equal stages without some knowledge of its length. My assistants had descended once in canoe; and the Indians who belonged to the upper settlements knew the river pretty well, but could form no idea, even superficially, as to distance, or the time the launch might take from Carapaná to Consacuntí; they were only accustomed to plodding along and punting their canoes, crossing and recrossing the stream at every bend, and thus losing much of the ground gained, to avoid the stronger currents. It behove me, therefore, to get together all the information I could, so as to be able to form some judgment on the matter; so two of the most intelligent Indians were called and cross-questioned, first one and then the other, very often their statements being most conflicting. The way such an examination was made intelligible to them and their answer to one's self was often very amusing, in a language that may be called *Pidgin-Spanish*, and very illustrative of the vagueness of the savage mind.

For instance, I would begin by endeavouring to gather an idea of the entire length of the river from their village to Tonantins, the place best known to them and the usual terminus of their voyages to the Solimoens, questioning thus:—(The translations of the conversation it must be borne in mind are literal, but are quite as grammatical, and convey just as much sense in English as in the original Spanish):—"Ese canoa andando Consacuntí cuando será llegandose Tonantins tiene?" *That canoe going Consacuntí, when will be arriving that Tonantins has got?* Reply: "Así luna será," *So moon will be*; showing one finger or two, or first one and then two on repetition

of the question—one indicating one month, and two, two months—a vague statement! So I would try: “Ese Consacuntí, Carapaná llegando, mas lejos será tiene ese Carapaná, Tonantins llegando?” *That Consacuntí, Carapaná arriving, further will be has got that Carapaná Tonantins arriving?* to which the answer was “Si, más lejos tiene,” *Yes, further has got*, which might refer to either, and upon closer examination did refer to either or to both! It is extraordinary how similar the construction of this Spanish spoken by these Indians is to the English as spoken by the Chinese; the “*tiene*” corresponds exactly to the “*have got*” or “*belong*,” used so indiscriminately in almost every sentence by the latter people.

Comparisons of large distances were evidently hopeless, so confining myself to the part of the road on which I really required information, I then inquired: “Ese Consacuntí saliendo, luna así tiene, Carapaná llegando luna donde será tiene?” *That Consacuntí leaving, moon so has got* (here I pointed to the easterly horizon, conveying the idea of full moon), *Carapaná arriving moon where will be has got?* The answer to this was a wave of the hand and arm westward, taking in at least 45° or more of the heavenly arc, by which I was to understand the position the moon would occupy at sundown, so pointing my arm steadily, with more precision, where I thought might be meant, I said: “No será así tiene?” *Will not be so, has got?* and received for reply “*No!*” which, however, it must not be imagined meant “*no*,” but “*yes*,” being a negation to my negative question.

It would be wearying to continue the long roundabout and varied ways in which I was compelled to treat the matter. Suffice it to say, that at last I had to examine the two men separately, making them tell me each spot or bank they would halt at every night successively on the journey, both up and down; then putting the two accounts together, I arrived at the conclusion that if I found no special objection afterwards, I should fix Oregones, Salado Grande and Incuisilla as the three stations before Consacuntí. Fortunately this determination turned out well, the distances between them proving sufficiently alike for my purpose.

The depth of the Putumayo is so variable, that to give any correct idea of it would be impossible without a complete survey. Near the mouth, on a line of soundings right across, I found it very deep, and only quite close up to the bank could I find 5-fathom water in which to anchor. At this time, though, the Solimoens was beginning to rise, but had not nearly attained its highest level.

During the first part of the voyage the river was somewhat flooded, and the short curves across the banks, close up to shore, were passable in never less than 2 fathoms, but by the time we reached Pohóna Cocha, about 20 miles below the Garaparaná, the water had fallen 5 feet, so that I found the shorter route (following closely round the lee banks) impracticable, in which I was confirmed the next day as we were going along some distance from shore. Seeing indications of shallow water, the lead was being hove, when suddenly, within the craft's length of a sounding of 3½ fathoms, we struck at full speed on to a mud-bank, the bow remaining firmly fixed, whilst the stern still floated in 3½-fathom water.

By shifting all the weight aft, no difficulty was experienced in getting off again; but this incident confirmed me in my determination to change tactics, and to continue in future following the main channel outside all the banks, a much more tedious procedure and longer route; but now that the water was falling, the only safe one. The formation of these banks merits some description.

From the upper end they invariably rise gradually and almost imperceptibly, but at their lower end mostly fall quite abruptly into comparatively deep water, so that in ascending the stream, excepting in very shallow and gene-



rally complicated places, with due care there is little danger of stranding badly. Indications of shallow water can always be detected on the surface by close observation, so that when these are encountered, careful soundings and a lower rate of speed enable one, in case of meeting an impassable barrier, to back off without any difficulty. This I always found to be the case, and by unceasing attention managed never to strike again unprepared or at high speed.

Now, steaming down with the current all this is different. It is far easier to get on a bank without knowing it until retreat is impossible, and often without even being able to see any sign of the gradually shallower water one is running into, until all at once the tell-tale line on the surface, showing the presence of the more elevated portion of the bank, is discerned close ahead, and on both bows. Here to slacken speed would be useless, to turn tail would require more time than the sweeping current would allow, and when stranded, to get off upstream against the whole force of the tide would be unfeasible; so nothing is to be done but to go on at full speed, and force the bank as far as possible, then seek the nearest point of deep water, and continue to force a passage with the aid of an anchor thrown out at some distance in the required direction to haul on, and a continual disturbance of the sand around the launch's keel and bottom. In this manner, with the assistance of the friendly current washing away the loosened sand, we got safely over banks on two occasions on the return journey; once after unceasing labours during more than a day, with all the crew working in the water.

Of course this system could not apply to all cases, and in ours only to banks covered with about  $4\frac{1}{2}$  feet of water, and fortunately when this is less they are proportionately easier to discern in time to be avoided. The launch, it may be mentioned, was iron, of strong build, 52 feet long by 12 beam, and drew 5 to  $5\frac{1}{2}$  feet of water, constructed for a river gunboat.

The water continued falling, so that after leaving Carapaná some crossings were passed in only  $1\frac{1}{2}$  fathom, and from here bare sand-banks began to be very plentiful, so we had to make up our minds to stem the strongest current, following the main channel. Navigation was simple enough as long as merely the snake-like curves had to be rounded, but in some of the straight broad reaches and intricate divisions of the river, no specially deep channel was to be found, and at times exit seemed impossible, all being shallow and full of bare banks of large area, until every promising outlet was searched and one with sufficient depth found.

However, no serious hitch occurred until the arrival of the festive season. On Christmas-eve troubles commenced. Forty miles below Incuisilla during the night the anchor dragged a little, though we lay under the lee of a sand-bank, and in the morning refused to be weighed, being doubtless entangled by a large sunken tree. Every expedient was devised to free it, and ropes severed and strong double blocks broken in the attempt. A high pressure of steam could not force it in any direction, so the entire day was passed in hard but futile labour. Early the next morning I sent a few hands into the woods to procure a large "balsa" log, so as to cut the chain, buy it, and abandon our emblem of hope, a resolution I arrived at very unwillingly, for it might cost us dear, and perhaps result in the worst—the entire failure of the expedition! However, to stay was equally bad. The last efforts had been made and no sign of ceding was visible, so the chain was about to be severed; but a farewell struggle was proposed, steam got up to double the usual pressure, all the chain slackened away, and the launch turned ahead at full speed to see if something would not give way. Something did, but fortunately it was the snag, and we found ourselves once more released.

At the Oregones and Salado Grande I had had firewood cut and left in readiness for the *Ucayali* steamer, and leaving our involuntary Christmas imprisonment, Incuisilla was reached without mishap.

Here we remained, as usual, wood-cutting, which operation generally occupied four days at each station, and may be here described.

The first step in the matter was to find a "loma" or hillock, which are few and far between, for it is only on high ground that hard woods are plentiful, with the exception of one in certain places, "Capirona" or "Palo Nulato," and the soft ones of the low ground are practically useless for steaming purposes.

Then the next essential was the choice of a spot which could be approached at low water, and where a steamer could make fast to shore.

Getting alongside in the thick vegetation was always attended with considerable discomfort, and the moment a rope was made fast, all hands, Indians and Negroes, brought their machetes and knives into hasty requisition to remove the over-hanging and penetrating branches of trees, which were invariably loaded with ants, and these frequently of vicious and warlike nature.

In one of our previous halting-places we had run into a nest of these pugnacious little creatures, suffering many a sharp nip in consequence, and throughout the journey did not get entirely rid of them from on board.

As the arrival at Incuisilla was at 6 o'clock in the evening, there was just time to make all snug before complete darkness came on.

As soon as day began to break, the Indians, reduced in number to eight men, as I had left three with an assistant at the Oregones, after drinking their "yoco," began to make the forest resound with the heavy blows of their sharp narrow-bladed axes on the hard wood, and in a quarter of an hour's time the tremendous crashing of the falling trees might be heard in different directions, as they came to the ground, tearing and splitting all in their close surroundings that attempted to withstand the weight of their fall. Sometimes, though, a tree was so firmly bound by strong lianas, twisted together, even and massive as heavy cables, from its boughs and the upper part of the trunk, that it would not fall in any direction, but remain suspended in the air when one or two logs had been cut off its length below. Up till nearly midday trees were felled and the trunks cut up into lengths of 3 to 3½ feet, and then breakfast, consisting of either turtle, fish, tapir, pirarucu, or turtles' eggs, whichever was at hand, with farinha, was demolished, and work resumed without loss of time. The logs cut were now carried to the bank, split into convenient sizes, and stacked close up to the water's edge. The first day passed in supplying sufficient wood for the launch, some 1400 logs, and the remaining three days were dedicated to the preparation of a stock for the *Ucayali*.

All ready in a suitable position, the bank had to be cleared so that the stack might not be passed unobserved from the river. All the outer bush was razed to the ground and the large overhanging trees felled into the water. Sometimes these would remain attached to other high trees by the lianas, and it gave much difficulty to free them. The Indians would jump into the water, and getting on to the half-sunken trunks and branches sever them one by one until the current washed them away, when they would swim ashore, leaving the port clear. The amount of hard work these Indians performed was truly marvellous, and confirmed me in what I had always observed, that for endurance their race is unequalled, even by the strongest negro or white, perhaps only to be approached in their specially wonderful performances by the Bettos of Japan and certain Chinese coolies. In the water they are untiring, swimming and diving for hours together; and in wood-cutting, especially hard woods, where none but powerful blows make an impression, one of the severest tests to physical endurance, their execution excites one's astonishment. There were days on which this work was carried on twelve hours without rest or food so that the job might be finished, for I had made them understand that a certain quantity was required, which once completed, the journey would be resumed, and as they were well treated and all very anxious

to reach their homes, they worked with a hearty good-will. In the afternoons, when energies were inclined to give in, I generally sat looking on, dispensing mild jokes suited to their understanding, and animating them to get the day's work done, to which they would gleefully respond, and with laughter, and real Indian whoops and shrieks, of which really the laughter mostly consisted, the tough logs were split with an enthusiasm bordering on fury. I have often thought since how desirable it would be if one could always meet with such diligent labourers, and so untiring; for these Indians, and I have found the same with others of the race, with good treatment, and constant supervision and encouragement, do more labour, and bear far greater fatigues and hardships cheerfully (or stoically) than any other people.

Many of the woods we used for fuel were very beautiful, and one especially, called "Palo de Bodoquera," it seemed a pity to burn. As its name implies, it is used for the manufacture of "bodoqueras," or blow-guns, which require a very straight and fine grain. The trunk reaches 50 to 60 feet without a branch or knot. The heart is a very dark mahogany colour and the outer wood quite white, so that when split longitudinally into segments, each log had the appearance of being composed of two quite different woods joined with mathematical precision, so straight were its lines, and so abruptly defined the two strongly-contrasting colours.

We passed five days altogether at Incuisilla, having prolonged the stay a day more than usual on account of the engineer's getting an attack of fever. A wooden cross was left with a journal of the voyage, enveloped in a package of leaves, bound to it, and we proceeded upwards again on the 31st December.

The river was getting very dry and complicated, with sometimes in the main channel only  $1\frac{1}{4}$  and  $1\frac{1}{2}$  fathom of water.

On the first three days of the New Year difficulties recommenced, and to make matters worse, I was still exceedingly weak and ill from an attack which had kept me completely prostrated for over a week. The water had become so low, and the bed of the river so much extended in several parts, that a passage seemed impossible. The first two days we got stranded for four or five hours each day, and had to labour very hard to get off, effecting a passage ultimately on each occasion through a complicated channel of one fathom of water, the deepest to be found. On the morning of the third day, 17 or 18 miles above the Semerí, in crossing a broad shoal which extended over the entire river, it was impossible to avoid running aground, and in backing off, the current seized the launch, and swung her, side-on, to a higher portion of the shoal, seating her firmly on the sand, which immediately accumulated largely under her lee.

We got a rope made fast to the shore and worked unceasingly until dark, discharging all the wood, &c., but night came on and found us still stranded, though much nearer to deep water than before. I let go the anchor and payed out plenty of slack chain, in case we should drift off in the night, as I hoped we might, the length of the chain being calculated to allow us to reach the deeper water near at hand. Fortunately my surmise, based on the continual shifting of the surface sand, proved correct, for early the next morning the current had accomplished its work and we swung free.

The river was then explored with a "montaria," and no outlet anywhere attainable, at last a very narrow and unpromising arm was sounded, and found to contain a narrow channel with 2-fathom water in its entire length, until it rejoined the main river.

As the anchor lay far above us in shallow water, it was got in suspended to the boat, and the "furo," "brazuelo," or arm, which was christened "Hondo Brazuelo," passed in safety. After this we met a strong freshet, which did not come unexpected, as heavy rain appeared to have fallen to the westward

for the last three days, and by the time the Cocáya was reached on the evening of the same day, the river had risen 8 to 9 feet, and was running with great force. These floods occur on all the streams, springing directly from the Cordillera with exceeding suddenness. In a single night the water rises up to 15 feet, as I have witnessed on more than one occasion, where the river may be already fully a quarter of a mile broad, tearing down banks, trees, and all that resists its mad career, so as to endanger all kinds of craft, unless very snugly housed and powerfully secured.

Eleven hours' steaming from the Cocaya brought us to Consacuntí, the first settlement of the Christianised Macaguáje Indians, as already mentioned, about 900 miles from Santo Antonio on the Solimoens. The same quantity of wood was cut here and at Montepa, the next settlement, about 100 miles further up, as at the other stations below, and at length we arrived at Yasotoaró, where the Prefect of Mocoa, the Corregidor of the Putumayo, and others, had been awaiting us for months past.

The entire voyage from Tonantins had occupied fifty-seven days, out of which we were actually steaming 372 hours.

The total consumption of fuel had been 12,822 logs, and only from Carapaná upwards the Indians who accompanied me had cut altogether over 25,000 logs.

The only important product at present extracted from the Putumayo Valley is Chinchona bark, on the slopes of the Andes bordering the upper streams. Some considerable quantities of this valuable article have been shipped to the United States lately by steamer direct from the neighbourhood of its production, hitherto looked upon as so utterly remote. On the rest of the river sarsaparilla and small quantities of india-rubber are found. The latter is presumably scarce, as on the Napo, where a thorough search for it has been made by an enterprising Colombian, with the poorest, in fact practically no results.

On the sand-banks turtle is very abundant, and its quality generally superior to that of the Amazons, probably owing to a greater abundance of food and the more undisturbed life it enjoys on the Iça. Pirarucú, and many other species of fish, are very numerous, and of easy capture to the initiated. Game of all kinds is plentiful away from the immediate vicinity of human habitations, though at times peccaries, and birds of many descriptions, may be found even at the very doors of the settlements, on their migrations or marches.

Amongst the most abundant game serving for food are many species of monkeys, two species of peccaries, two of Agouti, tapirs, capybaras, sloth, armadillo, deer, Curasow birds (Piuri and Paují), pavas, tinamús, a small pheasant-like bird called Pacharaca, macaws, parrots and parrots, pigeons, ducks, herons, several Toucans, and a beautiful goose (Guanána). Two or three species or varieties of jaguars are by no means scarce, and I was fortunate enough to fall in with a very fine boa about 18 feet long.

I have thus endeavoured to give a general description of a river which hitherto has been looked upon as one of the least known of all the larger tributaries of the Amazons. It appears to have presented difficulties and few attractions to travellers, for reasons which it is not necessary to analyse; but now anyone desirous of visiting it will find facilities for doing so not previously existing, being able to ascend to the very foot of the Andes by steamer; for though hindrances may have occurred on this first trip, it must be taken into consideration that some of the lowest water was encountered with a launch of unnecessarily large draught, and every passage of the river unknown and unexplored. Whereas now the ascent is made in a flat-bottomed boat of only 3-feet draught, and with Indian pilots who are beginning to know the river, and are learning the importance of noting the situation of all the sand-banks and the depths of the water.

There is, however, a dark side to this spot so full of riches to the lover of Nature; namely, in the first case the extreme unhealthiness of all the region, except, perhaps, the upper part of the river, and secondly, the Pium flies. Only those who know these bloodthirsty little insects can sympathise with people who inhabit or pass any length of time in places where they are from sunrise to sunset subjected to such irritating pests. They are plentiful on the entire river, from the Brazilian frontier up to the Cocaya, and are ever busy at their maddening work, to such an extent that, as mentioned of the Oregones, dwellings have to be kept constantly closed and dark, and out of doors in that oppressive temperature the neck and hands have to be kept closely covered, as otherwise the exposed parts are liable, by the irritation of their punctures, to large and painful sores. Such an insignificant little creature positively at times renders life a burden.

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3.—*The Translation and Transliteration of Chinese Geographical Names.* By F. PORTER SMITH, M.B. London (seven years a resident in Central China).

ALL readers of the public prints must have been struck with the varying orthography, or Roman equivalent, employed by writers on subjects involving the treatment or mention of Chinese places or persons. By "Roman equivalent" is meant the representation of the sounds of Chinese characters or names, in such letters as form the English and other allied alphabets of Western Europe. At a time when intercourse between China and the West has been formally and extensively established, it is most important that an accepted phonetic standard should be attempted. For this purpose the Geographical Society may be fairly looked upon as the best medium for promoting such desirable agreement amongst all authorities upon the question of *fixing* the proper names of Chinese places, &c., in European languages. This spelling reform is seen to be very necessary, when the Transactions of Societies, or the leading journals, are consulted upon Chinese matters. Each contributor or translator uses such phonetic equivalent as seems good in his own eyes, the consequence or assumed importance of the contribution being frequently signalled by some gross departure from accustomed renderings.

In a chance paragraph of the 'Times' newspaper, published in March last, as a telegram from the East, the *T'ien Shan*, or "Celestial Mountains," are spoken of as the Tian Shan Hills. The Chinese word for "heaven" is strongly aspirated, and the vowels used should be *i* and *e*, in keeping with the standard adopted from the Italian sounds of the vowels by Chinese scholars. As the word *shan* means "hill, or mountain," the word hills is a useless redundancy. The prefectural city of Lan-chau-fu, in Kansuh, is also called Lan-che-fu, the word *fu* marking the city as the capital of a prefecture, being run into the distinctive proper name. The city of Aksu, the Aukasia of Ptolemy, is also called Akasu. Some of these mistakes are, no doubt, sometimes purely clerical; but instances may be selected without number, in which the grossest liberties are taken with the standard renderings of proper names. The vowels *i*, *e*, and *u*, are constantly rendered by *ee*, *a*, and *oo*. Careless linguists assert that the Chinese cannot distinguish between the consonants *l*, *n*, and *r*; but the *liquidity* of these literal sounds is not a difficulty peculiar to the Chinese. The native scholars are exceedingly awkward in their transferences of European names into their own language, but still

their regular use of certain such transferences or transliterations should lead us to accept them as classical, instead of attempt to reform them. A still more serious difficulty is the fact that some of the more modern native authors have invented new renderings of foreign places, apparently in ignorance of their ancient equivalents, to be readily found in earlier dynastic histories. But our concern is not so much with this at present. In addition to the proper rendering of the vowel-sounds, indicated above, by single Roman letters, there is the matter of the preservation of the marks of accentuation and aspiration, always assuming that the Mandarin dialect is the standard of the language to be translated from. These marks should be carefully preserved in all cases. The *common* portion of the proper name of the place, &c., should be always kept distinct, or, better still, be actually translated. Thus, *shan*, mountain; *kiang* and *ho*, river; *hu*, lake; *hien*, *fu*, and *ch'eng*, representing the three ascending grades of towns or cities, and other descriptive terms, had better be fully translated. One is constantly reading of the *Shan* tribes on the western confines of China, as if *shan* were a peculiar name; whereas these people should be brought down to the name of hill-tribes. The name of the capital, Peking, and that of Nanking, should always be written with a final *g*. Almost every place, river, &c., in China, has its little-used archaic name, employed in the elegancies of well-read literary officials. These require a place in all Gazetteers, more especially as the various dynasties have made havoc with the names assigned by their predecessors on the Chinese throne. In translating the name of the Chinese sovereign, it would be much better to impart the proper title—*Hwang-ti*, or *Hwang-shang*—into the European language. We speak of the Sultan of Turkey, the Shah of Persia, &c., and analogy should lead us to dignify the Arch-emperor of China (as the name more accurately means) with his full title in the vernacular, as the Chief of all Sovereigns of the Universe. Similarly it would be better to describe the officials in something better than the sort of relative rank given them in books, where we read of Chinese generals, majors, ensigns, &c. Very excellent work has been done by Biot, Pauthier, Bretschneider, and others, in enlightening us upon matters of Chinese geography. On this and the converse, but cognate, subject of the transference of European geographical names into Chinese, much good work has been done by Dr. Wells Williams, lately Chinese Secretary of the American Legation in Peking. With the assistance of other Chinese scholars, press-managers, &c., he has compiled a standard Gazetteer of the world, or something approaching to it, in which all proper names likely to be used in telegraphy, translations of foreign works into Chinese, Anglo-Chinese newspapers, &c., are attempted to be smoothly transliterated into Chinese characters, representing, by their sounds, the foreign names. It would be desirable for the Society to procure, if possible, a copy of this vocabulary for the library, so that uniformity might be gradually brought about.

Dr. Medhurst, in his 'Geographical Catechism,' Malacca, 1819; Dr. Milne, in his 'Sketch of the World,' Malacca, 1822; Dr. Morrison, in his 'Tour of the World,' 1819; Dr. Gutzlaff, in his 'Universal Geography,' Mr. Way, in his 'Illustrated Geography,' Ningpo, 1858; Mr. Muirhead, in his 'Universal Geography,' Shanghai, 1854, and some few others, have rendered useful service in making the Chinese acquainted with the geography of foreign countries.

The assistance of some of the accomplished attachés of the Chinese Ambassador at the Court of St. James's might, no doubt, be obtained in the work of this reform. My own labours, as compiled in a somewhat crude form at Hankow, China, in the year 1870, having met with some acceptance, I should be glad to assist in the formation of such a standard vocabulary. Now that the University of Oxford has formally installed the Chinese lan-

guage and literature in its Oriental tripos, those who have been humble workers at the task of making the Chinese and European nations better acquainted with each other are greatly encouraged.

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4.—*Description of a Journey Overland to India, viâ Meshed, Herat, Candahar and the Bolan Pass, in the year 1872.* BY HIPPISELEY CUNLIFFE MARSH, Captain 18th Bengal Cavalry.

LEAVING Constantinople by the Russian Steam Navigation Company's steamer *Guniß*, I arrived in Poti, in the Caucasus, on the 29th of August, 1872; then by rail 124 miles to Guirella, to which point only the line was open; here luckily finding a diligence about to start for Tiflis, I took advantage of this and reached that city, the capital of the province, on the 3rd of September. After a few days, I started, with two friends and travellers, in a huge carriage with six horses, and after a rough drive, arrived at Baku on the Caspian on the 12th of September, and embarked on board the steamer *Duke Constantine*, belonging to the Volga line. After a rough passage to Enzeli we found we could not land, owing to the surf on the bar being very dangerous for boats; so we continued on our way to Ashurada, the headquarters of the Russian fleet; but on our return thence, the weather and state of the sea being favourable, we landed on Persian soil on the 20th of September.

After a few days' delay, owing to the effects of the famine having destroyed nearly all the horses, we were kindly started off on our journey by the agent for Messrs. Ralli Brothers, the well-known Greek merchants. We reached Teheran on the evening of the 2nd of October, after the usual adventures and trouble that attend travelling in semi-civilised countries. After a ten days' stay in the city of the Shah, where we were kindly entertained by Captain Pearson, R.E., the superintendent of the Government telegraph, our party broke up, and I was sorry to say "Adieu!" and "God-speed!" to my pleasant companions, and start on my lonely Chappar, or post-ride to Meshed. I had a Persian servant, and adopted a semi-Asiatic costume. As this route has been so lately traversed, I will not delay, but commence at once on the subject-matter of my Paper, viz. my ride from Meshed to Candahar viâ Herat.

Before entering Meshed, I sent on the note I had received from the British Embassy at Teheran, to our Vahil or agent, Mirza Abbas Khan. We entered by the Eedgah gate, which with the mud walls and ditch that surround the city was in a very dilapidated state, and right glad to have accomplished so much of my journey, about 580 miles.

During my stay in Meshed, I stayed with Abbas Mirza, the agent of our embassy at Teheran, who helped me to get myself properly dressed as a Persian, and purchase the animals required for my journey to Herat. Amongst other men I met at his house was one who turned out to be a pensioned native officer of our Bengal Cavalry, here on some government duty from India. He gave me much information, and proved useful during my stay. He had lately, with a companion, been to Merv to obtain information, which he kept to himself, but told me he had had all his clothes taken from him, one by one, by the Turkomans, who taking a fancy to any articles, would persist in having them given to them; and that they were the most ignorant brute-like people he had ever come across, their only care being their horses, and in that they were untiring. I was introduced to the Governor of Khorassan, the Prince Murad Mirza. After inquiring after my health, and if I had had any trouble since entering his district, I asked him for a letter to Sirdar

Yakub Khan of Herat, requesting permission to enter his territory, which he at once promised me, as also an escort as far as the Persian boundary. He said I should have no trouble in reaching Herat, as the road was good the whole way. The ark or citadel in which he lived was a tumble-down mud fort, with many intricate passages, courts and gates, tanks of water, gardens, &c.

On my way back to the Vakil's house a dreadful sight presented itself. On a dead wall at the end of a lane were three men crucified, with their faces to the wall, large wooden pegs through hands and feet and through the back fixing them in that position. These unfortunates were Turkomans the Governor had lately caught red-handed in a slave-lifting and burning raid on some villages in the neighbourhood. These wretches are the terror of the country and deserve punishment, but not such a death as that; some caught before had been flayed alive and left to die by inches—such is the civilisation of Persia! Next day, having completed my outfit, I appeared dressed entirely as a Persian, riding on my newly-purchased horse, a Turkoman animal of the Takke breed.

The next day, the 5th, was a momentous one for me, as I was to be left to my own resources; my departure from Meshed breaking the last link that bound me to European civilisation.

The next morning, the 19th of November, I was up betimes, and in came a lot of wild-looking men, armed and booted for the road, bringing several letters from the Prince to the different places I should pass on the road. They reported themselves quite ready to start. As my little cavalcade debouched out of the narrow streets into the Khiyaban, we made a fine show, clearing the road for the "Elchi Sahib," as they called me. We left by the Herat gate, and there my friends left me with many good wishes. Before leaving this very interesting city, I propose offering a few remarks on it. It is, first, interesting on account of its being to the Sheah Mahomedans a holy place, as its name declares, "Mushud Mukudus." There they bring the bones of departed friends, as all wish to find a resting-place within its hallowed walls; but lately, owing to the graveyards being too crowded, an order has been issued prohibiting their further use for a term of years, as of late they used to throw away all old bones and inter fresh bodies instead. Then, again, its geographical position, about lat.  $36^{\circ} 35'$ , gives it a perfect climate, its gardens producing very fine fruit and its fields two crops a year, with an unfailing water-supply derived from a canal taken from the Kusheff Rud, a river which rises on the southern slopes of the Koopel Dagh or Damun e Koh. To the north and west of the city the broad valley becomes narrow, wherein are a collection of flourishing villages, each surrounded by their fields and gardens, in which all the wealthy merchants have their summer retreat. To the south and west all stretches away in vast undulating waterless plains. And, lastly, its strategical position is of the highest importance. Here meet the roads from Teheran to the west; from Kelat, Kabushan and Merv to the northward; from Herat and Shiraz and Yezd, *via* Surbut Haidree, from the southward; a fit position for the capital of Khorassan. From here any advance on Persia, either by Russians, Turkomans, or Afghan forces, might be easily opposed; and, in case of Russia advancing on Merv, would be the fittest place for us to commence a counter-demonstration. Here a large army might be supported for months.

Our first march was to Sungbust, an old walled village and caravanserai, now in ruins. This village is supposed to furnish 100 mounted men by way of militia, instead of being taxed. A few of these were sent on with me; one of them had just returned from Merv. This place is daily acquiring more importance; but since its destruction by Nadir Shah in 1741, and its total depopulation by the Amir of Bokhara in 1787, who deported its population to increase that of Samarcand, it has never recovered the blow,



and, though called the chief town of the Turkomans, does not contain a single hut; but at certain seasons of the year, after harvest, the tribes assemble here with the produce of farm or flock, and pitch their black goat's-hair or felt tents amidst the ruins of the ancient Shah Zehan. In the great heats the town is again deserted, the River Murzhab then being nearly, and often quite, dry. The march to Furriman is devoid of water, the country easy to traverse, but quite deserted. This village is also a military fief of 100 sowars to Meshed, and has plenty of good land round it, but is devoid of water, owing to its insecurity from plunder. Notwithstanding these drawbacks, being situated in a narrow valley, it might be made a strong bar on the road to Herat.

The road was bad and stony, with small hills on all sides. From behind one, close to the pass, I was informed a Turkoman Allaman had attacked and plundered a caravan a few weeks before our arrival. As I heard that Burdo was nearer, and a better place than Abdulabad, we passed the night there. Hussun Khan of Furriman, who was riding with me, told me the Persian army was not properly paid, but that the men were really of good stuff, and, if well led, made excellent soldiers. The country wanted fostering; the people were very good, quiet, and ready to obey any one who protected them. They were poor, and produced nothing, owing to the uncertainty of human life there. On arriving at Abdulabad I found a thriving village, with its green gardens, and famous for its fruits, well-watered by a small stream from the Karez on the hills to the south. It used to produce silk. After leaving this green spot behind, the valley along which we had been travelling opened out into an open, undulating country, with a river-bed far off to the left. The direct path between Burdo and the next village, Mahomedabad, would only have been 3 fursaks, but stony hills intervene, which force the road to wind round to the south, making it 5 fursaks. The latter village can be seen a long way off, as it stands on high ground over the stream that comes from Abdulabad. In front of Mahomedabad is the ruin of the ancient city of Luriger, but the only building standing was the dome of the Abambar, or reservoir of water, and a tomb, both of masonry, raised to the memory of a relative of the Iman Reza of Meshed. This, they say, accounts for the fertility of the soil at this place, producing one wheat and two barley-crops a year. The village belongs to the Prince Murad Mirza. Eastward from here the country is dry and hot, no villages *en route*; many ruins of small forts, all showing we are coming to a devastated country, the stream from Abdulabad still running parallel to the road, but down in the centre of the valley a mile off, and all going to waste; the people also changing in appearance—the Persian costume giving way to the Afghan tall black Kulla, or sheep-skin hat, to the Lungee and choga. At Turbut i Sheikh Jam the people call themselves Jamis.

The country between Turbut and Karez, a small fortified village near the frontier, is for 36 miles flat, without trees or habitations, hills on both sides, but in the distance. I found the place deserted, as they had all gone off to the extreme frontier of Kybat; so I went there also, though out of my direct road. A great commotion had been caused throughout the country by an Allaman, which had passed along the Herat frontier, and they were gathering a force to cut them off on their return. The path between Karez and Kybat passes between sand-hills; beyond these hills lies a valley, and beyond that, again, a chain of high hills, called Dukhter Sang, south-east of us. I stayed a night here, and pushed on in the morning, the road being good, over a rolling, sandy country, to Katfir Killa, an old fort on the Persian Herat boundary. As I found no one there as I hoped, I went on to the banks of the Hurri Rud, which is a regular jungle. The river had little water at this season, 10 yards wide and a foot deep at the most, as most of it had been drawn off by canals higher up. This crossing having a bad name from robbers lurking in the reeds, I pushed

on as fast as we could, but saw fresh marks of horsemen, which, we were told on our arrival at Kohsam, the Afghan frontier fort, were those of Turkomans. I passed the night in this frontier-post with a party of Herat horse-dealers just from Merv, but, as they only spoke Turkee, I had not the opportunity of conversing with them. Our road to Subush was through a hilly but deserted country, easy to traverse, and parallel to the Hurri Rud. I was there met by the Chief of Ghorian, Abdul Zahir Khan, who had been sent by Sirdar Yakoob Khan to escort me to Herat.

Ghorian is a small fort of some strength on the south or left bank of the Hurri Rud, and was the first place taken by Yakoob Khan in '68, before he took Herat for his father in the same year. About 2 miles from the city, Atta Mohamed Khan Shaghassée, and others of Yakoob's officers, met me with a cloud of horsemen and guns, with which they escorted me into Herat. Khané Mushko Khan, the quarters provided for me, were close to the royal apartments, and were very clean and comfortable. Next day I had an audience with Yakoob, a fine, handsome young man, fair complexioned, tall, with a very intelligent face. He speaks five languages—Persian, Turkee, Pushtoo, Hindustanee, and a little English. He spoke to me in Persian, saying he had not had the pleasure of speaking with an Englishman for very many years, but hoped this would be the commencement of a greater intercourse with the "Sahibs" from India; then, changing, he spoke in broken English, vindicating his conduct with his father, the Amir Shere Ali of Cabul. Herat is a poor town, but is a very fine fortress, with high walls and deep ditch, and, commanded by Europeans, could be held by a native army against the rest of Asia. I had ample opportunities of seeing the place, also of thoroughly knowing Yakoob Khan, with whom I stayed eight days. He had lately been making a good battery of field-pieces, of which he was greatly proud.

Herat has been so often besieged and its walls battered down, that the débris of the former ones have made a huge mound, on which the present ones are built. The surrounding country is very rich, and is surrounded by mountains at a distance. On the north, at a distance of about 3 miles, commences a range of hills, which, at about 20 miles off, form peaks from 5000 to 7000 feet, with an east and west direction; to the south the westernmost spurs of the Seah Koh form an elbow with the Dushak Range from Persia, and about 20 to 30 miles off, leaving an undulating plain between them, watered by the canals from the Hurri. I left Herat by the Kandaharee Darwaza, by which Nadir Shah entered in triumph with all his Delhi loot in 1739. Its historical associations are interesting, and its climate healthful.

The road through the hills to the south, which are bare and dry, is rocky, and difficult to travel, and the pass of the Shabbad led us into a labyrinth of small hills and valleys, out of which I was glad to emerge at Subzewar, a small fort perched on a rock, watered by the Adreshkun Ab, the head of which we had crossed further north. This spot in a desert is held by one of Yakoob's fathers-in-law. The road then goes down stream as far as Juja, which it crosses by an easy ford, the river here forming the southern boundary of Herat territory, and that of Furrah commences.

The appearance of the whole country now changes, and instead of stony hills and dry water-courses, we saw an extensive plain reaching south as far as the horizon, with rounded sandy hillocks and quite deserted. The approach to Furrah is by a marshy plain formed by the overflow of the Furrah Rud, which has its rise on the southern slopes of the Seah Koh. I was greatly astonished on entering the town to find it only consisted of a few houses, although the walls are high and in good repair, giving the idea of a large city. The governor, Sirdar Mir Afzul Khan, being away at Cabul, I was received by his son Abdullah Khan, who is the brother-in-law to Shere Ali, he having taken the sister of the latter to wife, who is the mother of the boy Abdullah Jan,

whom Shere Ali wishes to make his heir-apparent, to the exclusion of Yakoob, his elder son. To the south of the town commences the large Seistan plain, for the possession of which Persia and Afghanistan had so long fought. Furrah is often deserted for want of water, when the people migrate with their large flocks of sheep to more favourable localities farther south. The favourite occupation of these people is raiding on one another's flocks; and to show the insecurity of life in these regions, all strangers are looked upon as enemies till they prove themselves otherwise. From Khor Malk to Bukwa we traversed a desert tract, with no special features to describe except that we skirted a range of low hills, to the north of which runs a road parallel to ours, from Shaiwan through Choran, Ganimurg and Ikling to Grishk, and which is generally followed in the summer, owing to its being better supplied with water, although it is not so easy a one as that which I was following. At Bukwa the Ead festival was taking place; consequently I was greatly delayed, and only got as far as Sake, a small encampment of shepherds.

My party here consisted of about twenty, who had collected for mutual protection. Our way lay over a bare gravelly plain and crossed the dry bed of the Ikling Joce, which only contains water in the spring; then onward till we reached the Kash Rud, now nearly dry, and following its right bank, we arrived at the old ruins of Dilaram, where we halted for the night. This old ruin is a station for the post-runners; a few wild Atchakzaie take the letters between Herat and Candahar. This Kash Rud is a stream nearly as large as the Furrah Rud, and rises in one of the valleys on the south of the Seah Koh, near the pass of Kohistanee Baba, and joins the Helmund, after a long course, near the Seistan Lake, close to Guz Keri.

The bed of the river was full of jungle, but we easily crossed and found a worse road than yesterday; as we ascended the river and followed its bank and then branched off, a long ravine led us over a vile road right up to Washere, where we came upon the northern road, of which I have already spoken. Washere is mostly composed of tents; there are a few huts and walled enclosures, but the houses of former times are all destroyed, and the place much reduced by the army that was sent towards Herat two years before my arrival.

On leaving this village next morning I found my escort consisted of only two men, at which my companions were rather alarmed, asserting that the road became less safe as we neared Candahar, owing to the numerous loose characters about.

At Ikling, the first village after leaving Washere, close to the road-side is a curious stone pillar, but of its history I could learn nothing. The path from here began to enter the low hills that cross the country from east to west, and after hours of plodding we came out into the plain again. Water is very scarce, and everything looked quite burnt up, nevertheless these hills afford good grazing to large flocks of sheep. As the sun was getting low, we saw some peaks in the distance, apparently isolated, but as we neared we found they were all joined into a group by lower hills. Between two of these hills, in a small valley, we suddenly came upon an encampment of Eliots in their blanket tents. They had only been here a few weeks, and had just completed the repair of their Karez, as this place, called Beobanak, had been uninhabited for several years previous to my arrival. We slept for the night there, and in the morning as we left the encampment we had to pass between two hills that divide Washere from the Grishk country; through this narrow gorge a cutting wind met us off the Musa valley to the north. The road then passes over the level country to Mahmudabad, a small village in a hollow, watered by a Karez stream; beyond, over an undulating country and across the head waters of a small tributary that joins the Urgundab at Gudar to the south, and then came to the old mud fort of Sadut, built fifty years before by Dost Mohammed

Khan's brother, Khoondil Khan, for the protection of his family and treasure. From here we all were on the look-out to catch a glimpse of the towers of Grishk, and, after dark, a solitary light guided us off the plateau we had been traversing, down into the valley of the Helmund. The fort is in a very dilapidated condition, and as it was dark, and the people afraid to let down the draw-bridge, we had to ford the ditch and scramble up the escarp.

The next day being Sunday I halted for the day, and had a wander round, and found amongst the crumbling walls many marks left of our occupation there in 1840, and amongst others a gate and bastion made by Sir Henry Rawlinson, who was then our Political Resident at Candahar. From the top of the walls a good bird's-eye view is obtained of the surrounding country and villages, with the River Helmund and the ruined fort of Nadali opposite. The valley of the river is here broad, and, as far as the water would reach, was beautifully green and fertile; the large canals coming from the river irrigated the gardens and fields, and filled the moat round the fort. This important position commands the road to Herat and Candahar, and the ford of the Helmund, which is generally too rapid and deep to be crossed at all points. The bank and sands bordering the rivers are covered with jungle, full of game. Through this we had to pass, as we took our departure next day, to renew our desert march towards Candahar; stopping at Miskarez for the night, a small village where I only got salt and liquid mud to drink, and the whole of the next day we had to ride without water. At last, late in the evening, on the horizon we saw a range of sand-hills, and shortly after a few horsemen rode out to meet us from the village of Aushukhan. The River Urgundas runs close under the hills to the south, and the right bank along which I passed has many villages situated within its green and fertilising influence.

On the 12th of December, 1872, I entered Candahar, and the agreeable surprise that awaited me on entering raised my hopes to the utmost as to what my reception would be at Cabul.

While at Candahar, Yakob Khan's wife passed through to join him in Herat, as also his younger brother Aioob.

I made great preparations for my approaching journey towards Cabul, purchasing warm things to keep out the great cold, which was reported as excessive by a Kafilā just arrived; but on the 14th of December I was shown a letter just arrived from the Amir at Cabul, asking me if I had had permission to travel by my government, and if not, I was not to think of going to Cabul, but to depart at once for India by the lower or southern road, *viâ* Quetta and Kelat.

As this put an end to all hopes of reaching the capital, I started off as soon as I could for Quetta, so, on the 16th, I left Candahar with as great state as I had entered. A young Populzaie Khan accompanied me to Quetta. We left the sterile hills and plains of Candahar and dipped down into the green valley of the Loree river which was distant about 24 miles. From Candahar to our Indian frontier they count in coss instead of fursaks, as in Khorassan. Our road followed the course of the river, crossing many tributary streams and canals; as also the Turnak river, a slow muddy stream, and the Arghasan, two tributaries of the Helmund. Our first stage was Tukhtapool, a small village amongst low bare hills inhabited by Atchakzaie, a lawless set of robbers. The next day the first part of the road was very stony, through the same low hills, named Koh-i-Gantai, which we had entered yesterday; emerging out of which we crossed a plain without water, and in the evening camped in the midst of an Atchakzaie Kheyl, a most interesting sight to see those wild tribes in their own home. Next day, after crossing another large tract of twenty miles without water, we camped with a poor man and his family at the foot of the Khoja Amran range of hills; the next day, or the fourth from Candahar, we crossed by the Rogni Pass this range that we had seen for the last two days.

We ascended from the plain by a gorge, along a most vile path, and after two miles came on the "Chumun," a spring of water—one of the spots well remembered by our army on its march to Candahar in 1838, and used as a halting-place, owing to its open glade and spring. We then approached the summit by a goat-track, and from the pass looked down on the plains on both sides; to the N.E. on those through which the Kudania stream runs, and south-west into the Pesheen valley of the Lora, both sides yellow and parched; but the wind blew cold from the Candahar direction. Pesheen valley is reported to be rich and fertile, but I saw little to attract the eye. Across the Pesheen plain and the Lora, a muddy stream, we rode over a Kotul in the Shawl hills in the Quetta country. These desolate and low hills are the boundary between Afghanistan and Khelat. As we could not reach Quetta or Shawl that evening, we slept at the small village of Billilay, and next day marched into that well-known fort. The country lies high, as the elevation of the fort is about 5500 feet above sea-level, and it is built on a natural mound, the foot of which is protected by a wall and ditch. I was well received by the Khan of Khelat's Naib Abdullatif, who turned out his small force to salute me, and brought me to the fort and installed me in my quarters. As soon as I had the opportunity, I asked for permission to pass through the Bolan on my way to Jacobabad. He reluctantly assented, so early next morning I turned out of the fort; I told him to send the guides after me. I made only a short march that day to Sircub. By the evening my men arrived, and at midnight I started, as I was anxious to reach the mouth of the pass before any one could give the information to the robber tribes that infest it. As soon as it was light we crossed the Kharlaki, or bar that closes the defile from the plain, and descended into the bed of the Bolan. The difficulties of this route are naturally very great, but when Kafilas and unarmed travellers have to hurry through for fear of harm or death, the obstructions are multiplied exceedingly.

Of its entire length of sixty miles we did the first part, or forty miles, straight off, without delay, passing the well-known halting-places of our advancing army in 1838. As we neared the town of Dadur at its lower or southern end, the pass widens out, and we debouch into the plains; having descended the whole way from 5000 to 1000 feet. From here to Dadur, which is within our Sind frontier, is a vast plain called the Put, uninteresting and barren. And here I came across an English officer, and was thankful to have finished my journey by the 5th of January, 1873.

5.—*A Visit to the Mungao District, near Cape Delgado.* By Dr. J. KIRK,  
H.M. Consul-General, Zanzibar.

TAKING advantage of the movements of H.M.S. *Philomel*, I last month visited a few of the trading stations of the district of Mungao, the most southerly division of the Zanzibar dominions.

The district of Mungao extends along a hundred miles of coast, from Kiswere, in s. lat. 9° 25', to the small stream that forms the limit of the Sultan's territory in the Bay of Tungi, at Cape Delgado.

Previous to the survey carried on by Captain Gray of H.M.S. *Nassau*, in 1875, little was known of the different harbours of this part of the coast, and before 1870 the trade of Mungao consisted of a little copal, orchilla weed, and cowries, but principally in slaves that came from the Nyassa Lake.

During the prevalence of southerly winds, slaves were sent to Zanzibar, Somali Land, and Arabia; when the monsoon changed, Arab vessels transported slaves to the Comoro Islands and Madagascar.

So late as December 1873, Vice-Consul Elton described the condition in which he found the Mungao District as follows. "Trade is at a stand-still; copal digging is entirely stopped, the diggers being sold as slaves when on their way to the coast. Since then, Mungao has not been visited, as it became a matter of great importance to ascertain how far—the slave-trade being stopped—legitimate commerce had revived, or whether the trading-stations had not been ruined by the measures referred to, and the country abandoned.

In Zanzibar it was almost impossible to learn much, and nothing of a reliable nature, so various are the motives that influence native merchants to conceal the extent of their trade, and the sources of their profits.

The chief result of the hurried visit I have been able to make has been to show that throughout the whole district of Mungao the slave-trade is at an end, the road to Nyassa now little used, the principal chiefs who carried on the wars that depopulated the district so late as 1873 having become settled and industrious, and a commerce sprung up that in one year has reconciled the people of Mungao to the new state of things, and opened to them a source of wealth, but one wholly incompatible with wars and slave-trade. Last year the export of india-rubber from the Mungao district amounted to 1,400,000 lbs., which represents 400,000 dollars value, or, approximately, 90,000*l*.

In this new industry, Machemba and his people, who before were the scourge of the district, have taken the lead. There are, besides, many other sources of wealth, for that region is suited for agriculture, and abounds in copal, cowries, orchilla-weed, ebony, calumba-root, and dye-wood; while inland there is coal of good serviceable quality, and iron in abundance.

Wherever I came in contact with the people I was glad to find the want of labour generally acknowledged and felt, and to meet with no sign of the slave-trade, the Nyassa caravans now passing by a direct route inland, and not through Mungao, as before.

The plans and charts of this coast lately published by the Admiralty will show that it abounds with spacious harbours, some of which are land-locked, with deep approaches, and capable of receiving the whole British fleet. The chief of them are Kiswere, Mehinga, Lindi, Mwanja, Mtwara, and Mikiadani.

As the question of a road to Nyassa is one that of late, in consequence of the movement set on foot by the King of the Belgians, has attracted some attention in England, I may here state that any one of these places would afford good stations as a basis for operations; but I found the Tsetse-fly dangerously prevalent in several of the best localities, and this, where it occurs, would for the time make a road impracticable. This fly has now been seen at the Rovuma, Mikindani, and Mehinga. No doubt it exists also at Kiswere, so that I should, on this account, select Lindi as the most suitable, there being apparently a more peopled country inland; and Bishop Steere, who has adopted this as his point of departure for the interior, has not observed the fly on his line of road. As, however, I am not aware that the Bishop is personally familiar with the fly, the ground would require to be well examined before a trustworthy opinion could be pronounced on a matter of such vital importance as the selection of a proper road.

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6.—*Overland Route to China viâ Assam, Tenga Pani River, Khamti, and Singphoo Country, across the Irrawaddi River into Yunnan.*  
By HENRY COTTAM, Esq.

Deyanawatte Estate, Badulla, Ceylon,  
November 27th, 1876.

A GENTLEMAN residing in Luckimpore, Upper Assam, one who has travelled much in nearly every part of the world, had made up his mind to attempt an entrance into Chinese territory *viâ* the Khamti and Singphoo country, and across the Irrawaddi River into Yunnan.

For the above purpose he went to considerable personal expense in the outfit of a small Expedition, and engaged eighteen followers as under :—

One Sepoy of the 44th (*on leave*); one Brahman pilgrim from Benares; one Assamese cook; three Bengali coolies for carrying provisions; six Dhooms (Assamese canoe-men); four Khamti guides and interpreters; two Mishmi mountaineers.—Total, eighteen.

My object in visiting Assam was principally to draw up a series of Letters on Tea Cultivation, for the benefit of planters in the Island of Ceylon; also to describe the country and its people; the manners and customs of the numerous Hill-tribes on either side of the great Assam Valley, through which flows the noble Brahmaputra River, which in the rainy season is no less than 15 miles wide *in parts*, with a very strong current.

My companion in travel met me at “Sadiya,” the camp on the British frontier. Here we had witnessed the Mela or annual fair, the meeting of the Hill-tribes, who numbered upwards of 2000 men, women, and children, chiefly consisting of Mishmis, Singphoos, Khamtis, and Meerees.

The Nágás, though seen on the road carrying cotton and other produce, did not attend the Mela. The exchange of produce lasted a week, enlivened at intervals by races and field sports, after which the savages retired to their mountain homes.

Sadiya is about 870 miles from Calcutta, 150 miles of which may be done by railway; 660 miles from Goalundo to Debrooghur by steamer, and 60 on horseback.

Our little party left Sadiya on the 14th of February, 1876, the weather anything but promising to be fair. C. H. L. and myself occupied the first canoe, the Assamese and Bengali servants a second, and the Khamti guides a third.

The thermometer was below 60°, and drizzling rain descended all day.

We passed a Meeree village on the left bank of the Brahmaputra, and camped a few miles above it on a sand-bank, where our people made large log-fires to keep away wild beasts.

A storm came on in the night, which completely washed away everything in the shape of huts and our tent of tarpaulin.

The following day we camped at the mouths of the Tenga Pani and Noa Dehing rivers, and, on exploring the banks of the Noa Dehing, found it silted up to such an extent that our canoes could not go up. We therefore decided on entering the Tenga Pani, and arrived at a Khamti village called “Juna.” Here we camped for the night, and the following day passed a village called “Latow,” inhabited by Singphoos.

Our canoe-men had much difficulty in poling over the numerous rapids, many of which running at the rate of 10 miles an hour, but, fortunately for us, they were not very deep. Some of the islands on the River Tenga Pani are very picturesque, one in particular called Shi Kar Maseli Kopali (Fisher-man’s Island).

We approached another similar wooded islet of great beauty, called "Bor Kopali," meaning in Assamese "large island."

About 2 P.M. we passed the junction of the Tenga Nuddi and the Tenga Pani, joining at an acute angle. The Tenga Nuddi enters the Tenga Pani on the left bank.

The Khamtis informed us that we might go up the Tenga Nuddi without seeing a house or a man for six or seven days' journey. At 5.15 P.M., fourth day from Sadiya, we sighted the village called "Shang Kām," and rounding a densely wooded island, where the rapids ran with great impetuosity, our men, poling with all their might, brought us to an anchor.

The scenery up and down the Tenga Pani, looking at it from the village ghāt (or landing-place), is extremely beautiful, and directly opposite stood an old tree, clothed from top to bottom with orchids and climbing ferns, hanging in festoons from the branches near the water.

We camped at Shang Kām for two days, dried our clothes, and wrote up our notes. The Khamtis appeared to be an industrious people. The men cultivate rice, with the assistance of Mishmi mountaineers, whilst the women weave their own grown cotton into neat-patterned cloths for themselves and their children. A Buddhist priest instructs the children in reading and writing, and they read their lessons aloud in his verandah.

The village of Shang Kām contains about twenty well-built houses, raised on piles or changs, around which may be seen the orange, lemon, lime, mango, jak, peach, plum, and guava; also patches of opium-poppy, Khamti tobacco, and onions, &c., cultivated and fenced in on the banks of the Tenga Pani.

The following conversation with the Rajah of Shang Kām is important, as it refers to the overland trade-route to China.

Chow Mung Thi is employed by the British Government as interpreter to the Deputy-Commissioner, and we met him at Sadiya during the Mēla. He then promised to escort us to China direct by the Khamti, Singphoo, and Irrawaddi route, into the Chinese province of Yunnan.

The conversation we had with him regarding this subject, with a more detailed description of our journey, was published by my companion in the 'Calcutta Englishman,' and by me in the 'Ceylon Observer,' Colombo.

In reply to Mr. L.'s questions in Assamese, Chow Mung Thi spoke as follows:—

"You could not possibly go to China at this time of the year. The rains have begun, and you could only get to Khamti and have to wait there till next cold season, as you could neither get back nor go on. What would you do then? The paths are very jungly, and there is snow to cross; you have to march in watercourses, which, although you could pass now, you will find impassable on your attempt to return. The journey would kill you now, and would be very hard work for my people. If you did get to China, and went on as you propose, what would become of my people?"

"It is just the season for beginning to attend to our rice-farming, and these men would not get back." (This, we believe, was his principal reason for obstructing our progress, for he probably wanted the men himself.)

"You have only one steep hill, and that you can ascend and descend in one day.

"It is all very well your saying you came to expect great hardships, but you don't know what is before you now; if you offer me 30 rupees per diem I will not go with you. I will get you some men. You say you want thirty to carry everything, including their own food, &c. Well, I'll try and get them; but it will cost you a rupee a day for each man, or 900" (900 rs. for the thirty men per mensem); "and, if you succeed at all, it will take you at least two months, i.e. 1800" (1800 rs., or 180l.), and the return-journey for the men!



"If you try next November instead of now, I'll go with you myself, and write to the Singphoos and bring them in, arrange everything, and the men will only cost from six to eight annas (from 9d. to 1s.) each per diem, and you can give me what you like."

Here was an obstacle we did not anticipate, and we tried to reduce our baggage; but, as we should have to carry sixteen days' provisions, we did not see our way to curtail the number.

We became convinced it would be useless attempting to push our way to China without the consent of Chow Mung Thi, whose influence extends throughout the Khamti country, and even with the Singphoos. We had another interview with the Rajah, when he informed us that he had visited China and also Calcutta."

The cross-questioning was resumed, and the following are the answers:—

"If you determine to go next dry season, give me a few months' notice, so that I may arrange with the Singphoos, for they are a wild people; and although they behave themselves when at 'Sadiya'" (the British frontier) "and in Assam, away from their own country, for fear of the 'Sahib'" (Deputy Commissioner), "in their own country they are very different, and very exacting from strangers. When I went through their country, they cost me over 300 rs. (30l.) in presents alone! So you can see what it would cost you, a Sahib, to go through their country. At home they are almost savages, hardly dressing themselves, and doing very little cultivation.

"Mr. Cooper, when he tried to go to Thibet through the strip of Mishmi country which lies between us and Thibet, took 500 rs. (50l.) with him from here, and only brought back 100 rs. (10l.), with only four men. The distance to Thibet takes us eight days only. Mr. Cooper took thirty days accomplishing a distance which our people can walk in four days."

We hear from Europeans in Assam who met Mr. Cooper, that he was turned back by the Mishmi mountaineers near one of their cane bridges. A chief presented him with a dhow (native sword) and spear, and said: "Take these to your Queen, and tell her these are the weapons we fight with. You cannot enter Thibet, it is against the order of the Chinese Government. Go back, or we will kill you."

Chow Mung Thi went on to say:—

"Hobong is eight days' journey from us, but sixteen for you; and no supplies of provisions on the road. Then it takes eight days more to reach the Irrawaddi River, and it will take you at least sixteen or eighteen days."

(Hobong, the Khamti village, must not be mistaken for Hookung, nearer Burmah, and the site of the Amber mines, near the Irrawaddi River.)

"Then it takes eight days more to reach the Irrawaddi River, and it will take you at least sixteen or eighteen.

"It is between Hobong and the Irrawaddi River that the ascent has to be made I told you of. A little past Hobong are the two hills of almost pure silver, a sample of which I have given you. There is a great quantity of gold there too, from which the name of our little colony is named Khamti, meaning gold country, and by which name you Sahibs call all of us, who are really Shans, from Chan or Shan, a country nearer China, having a strip of Singphoo country between us. The Singphoos again lie between Shan country and China.

"I gave Captain B. a large sample of our silver ore, but I don't know what he did with it" (probably destroyed when the Kachcheri was burned down in Debeooghur). "We have got a quarter seer of silver out of one seer of ore from our place (a seer is two pounds, thus half a pound of silver to two pounds weight), and three-eighths of metal (30 rs.) out of one seer from another place. The hills are bright with it, and look like the sample I have given you."

We were informed that the Chinese have made periodical visits to the

silver mine, and built a screen to prevent the Khamtis from seeing their *modus operandi*.

The want of opium and sufficient money to pay our way was the cause of our return *viâ* the Tenga Pani into the Brahmaputra; and as we obtained Government passes to visit the Brahma Khund, we proceeded on our journey up the Brahmaputra as far as navigable. Tigers, wild buffalo, and deer were seen on the banks of the river; but the object of our trip was to gain geographical knowledge, therefore our party did not often indulge in sport.

*Friday, 25th February*, twelfth day out, we reached the head of the Karam River, or, as the natives call it, the "Karam Pani." Another river, called the Subatu, meets the Karam, a few miles from the Brahmaputra. Wild duck were plentiful, and the river abounds with Marseer fish (Indian salmon), 64 lbs. of which we succeeded in landing in one day.

We camped at "Man Kooti," meaning buffalo grazing-ground.

The difficulties we encountered with the rapids in the Karam Pani were greater than those of the Tenga Pani for our people. All hands had to assist in dragging the canoes over the rocks, and the waters rushed through narrow channels with great fury, foaming and roaring in a manner calculated to alarm any one but an old traveller; they reminded me of the coral reefs of the Fiji Islands and South Seas.

*27th February, 1876*.—Fourteenth day from Sadiya. We commenced our overland march in the direction of the Brahma Khund; camping on the bank of the Karam Pani, and built our huts of sticks and leaves. Marching up the bed of the river all next day, as we looked up stream, the large gorge in the hills in which the Mishmi mountaineers say the Kamlun or Karam rises directly facing us, 30° s. of E., and the Brahma Khund is a little north of east of us. The snow-clad giant mountains of the Himalayan range stood out in bold relief with the sun shining on them, and often rooted me to the spot in silent admiration.

The following day we resumed our march, leaving the Karam River behind us, and abandoned our huts in the centre of the bed of the river, on mounds of sand and stones, with streams and small rapids flowing on all sides of our camp. Again we encountered a fearful storm, and suffered great inconvenience. The jungle we had to march through consisted of cane and bamboo, the most troublesome of jungles to cut one's way through.

Entering the jungle on its right bank, through this disagreeable undergrowth of cane and bamboo, we continued east by north, until we entered the dry bed of a river for about a mile, when we suddenly came upon a river running at right angles to it; this river is called the "Lohit." Following its course on the left bank for a short distance, we then waded across, and proceeded along its right bank for a time, and crossed it again, using its left bank.

Having followed this river's course for more than a mile, we came to another dry river-bed at a bend in the "Lohit," which met the bend nearly at right angles on the left bank. This dry river-bed might be described as a valley of ferns, skirted by a dense cane-growth, until we ascended the jungle, and marched some distance under the shade of heavy forest trees, clothed with many descriptions of orchids and wax plants for about two miles, when we were agreeably surprised to find ourselves once more on the banks of our old friend the Brahmaputra, which we hailed with delight, after so much jungle travelling, although a very cold breeze was blowing down from the mountains.

We had now arrived at the most difficult part of our journey, having to jump from boulder to boulder for a great distance along the left bank of the great river; entering the jungle again for a short distance, and again emerging on to the boulders, with about one mile of jumping to do from one stone to

another, many of which gave way, and caused unpleasant sensations in slipping. At last we came to a sand-plain fringed with grass, and on this we agreed to camp. Already the Mishmi mountaineers had erected some rude huts, and our people gladly took possession of them to shield themselves from the heavy rain which had drenched us all.

The Brahma Khund bore 3° north of east from our camp on the sandbank, until we came to the edge of the jungle, which we entered, and a hard hour's march we had of it before we came out again on the banks of the Brahmaputra. Here we found exercise à la chamois hunter, jumping from boulder to boulder for about a mile and a half. This kind of exercise accounts for the muscular calves of the Mishmi mountaineers, both male and female.

Now and again we would stop to admire the grand scenery on the opposite bank of the Brahmaputra River, the hills rising abruptly from the water's-edge, and in the distance we could see the Khund. A very cold, strong, but healthy breeze was blowing down stream, which, with the prospect of soon arriving at the end of our journey, put new life into all of us.

Again entering the jungle, ascending steep paths only fit for the Mishmi mountaineers, for it was slippery and full of thorns, with overhanging rocks and fallen trees in our path, we suddenly came upon the famous Brahma Khund, the sacred pool of Brahma, and the main object of our visit, the first civilians who have visited it alone and unprotected.

The Brahma Khund, or Sacred Pool of Brahma, is a bay dependent principally on the Brahmaputra River for its support or supply of water, for we could see plainly the Brahmaputra issuing from between the two nearest hills to the Khund, and, whilst supplying the river, sending a backwater into this small bay, enclosed by rocks nearly perpendicular. The Brahma Khund is a romantic piece of wild scenery, enclosed by rugged, overhanging rocks and precipices, from fifty to several hundred feet in height, the contents of the bay being principally supplied by the Brahmaputra; for, as we sat at the foot of the Sacred Pool, we could see a backwater flowing into and retiring from it; whilst again it is fed by the Deo Pani, or Godly Water, which forms a small stream, and drains the surrounding elevated land (the Mishmi Hills).

There is a projecting rock, over which we climbed, and there caught a glimpse of the mighty Brahmaputra, rushing and foaming through a deep chasm, as though angry at being enclosed in so small a space. (This outlet is about two hundred yards from the Khund, and can only be seen by climbing over the rocks.) How anxious we were to explore its banks and find its true source! but, alas! we were short of rice, and our men refused to go an inch farther; refused even to fetch a tin of rice hidden in the jungle on the bank of the Karam, intended for our return journey. (The rice was hidden in the jungle on account of our inability to carry it, and to check extravagance.)

But, to return to the subject; the castle-like appearance of the rocks, the Deo Pani Cascade, the roaring waters of the Brahmaputra issuing from an unexplored region, the Mishmi Hills clothed with forest to their summits, and our little camp in the midst of so much romantic scenery, produced pleasing sensations. All these things had to be weighed in the scale against our pet object being thwarted, and the discovery that the Brahmaputra was still a heavy body of water sweeping round from the Himalaya, and probably running through Thibet and China.

The most remarkable feature of this journey was the fact of our encountering heavy rain, with thunder, lightning, and strong winds, from the day we left the British frontier until our return to Sadiya, *22 days out*, where we found 16 buildings had been blown down on the night we were moored at the mouths of the Tenga Pani and Nca Dehing; many were of opinion that it was a cyclone.

We have both kept our journals of this journey in full detail; and should

the [Geographical Society wish for further information regarding the rivers and villages in the Mishmi and Khamti country, both of which are excluded from ordinary maps, we should only be too glad to make another attempt to enter China.

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7.—*Table of Distances on the River Amazons.*

By LLEWELLYN NASH, Esq.

Pará, July 3rd, 1876.

By the medium of Mr. S. W. Silver, I forward a Table of the distances in geographical miles of various towns and places of call on the River Amazons, from Pará to Yurimaguas, in Peru, which it may be agreeable to you to receive. The calculations are founded on the experience of upwards of twenty voyages of different steamers, and I believe the Table to be more correct than any yet published. The latitudes and longitudes are incomplete, but I was unable to take observations.

I am indebted to Mr. Simson, an English Naturalist, lately from Guayaquil, and to Don Rafael Reyes, of Popayan, on the River Putumayo, in Columbia, for assistance in forming the Table, especially as regards that portion between Yquitos and Yurimaguas, in Peru.

We are opening up steam communication with Columbia, by the River Iça, or Putumayo, and may probably be in a position to gain geographical knowledge regarding remote countries on the eastern slopes of the Cordillera of the Andes, and if you will direct my attention to especial points of interest to your Society, I will endeavour to secure reliable information.

*To the Secretary, R.G.S.*

TABLE of DISTANCES in GEOGRAPHICAL MILES of various TOWNS and STATIONS on the

136	Breves.															
204	63	Bom Jardim.														
269	133	65	Gurupá.													
529	393	325	260	Santarem.												
607	471	403	333	73	Obidos.											
633	497	429	364	104	26	Alvarenga.										
713	577	509	344	194	106	80	Villa Bella.									
794	653	590	525	265	157	161	81	Capella.								
872	736	663	603	343	265	239	159	73	Serpa.							
996	860	792	727	467	339	363	233	262	124	Manaos.						
1065	929	861	796	536	453	432	352	271	193	69	Manacapurú.					
1132	996	928	863	603	525	499	419	333	260	136	67	Anaman.				
1194	1058	990	925	665	537	561	481	400	322	193	129	62	Cudajas.			
1213	1077	1009	944	684	606	580	500	419	341	217	143	81	19	Tamandaré.		
1253	1122	1054	939	729	651	625	545	464	386	262	193	126	64	45	Porto Charles.	
1300	1164	1096	1031	771	693	667	587	506	428	304	235	163	106	87	42	
1396	1260	1192	1127	867	789	763	683	602	524	400	331	264	202	183	138	
1423	1287	1219	1154	894	816	790	710	629	551	427	358	291	229	210	165	
1444	1308	1240	1175	915	837	811	731	650	572	448	379	313	250	231	186	
1583	1449	1381	1316	1056	978	952	872	791	713	559	520	454	391	372	327	
1609	1473	1405	1340	1080	1002	976	896	815	737	613	544	478	415	396	351	
1795	1659	1591	1526	1266	1188	1162	1082	1001	923	799	739	664	601	582	537	
1922	1786	1718	1653	1399	1315	1289	1209	1129	1050	926	857	791	728	709	664	
2006	1870	1812	1737	1477	1399	1373	1293	1212	1134	1010	941	835	812	793	748	
2073	1942	1874	1809	1549	1471	1445	1365	1284	1206	1082	1013	907	884	865	820	
2031	1945	1889	1812	1552	1474	1443	1363	1287	1209	1085	1016	910	887	863	823	
2125	1989	1931	1856	1596	1518	1492	1412	1331	1253	1129	1060	954	931	912	867	
2251	2115	2057	1982	1722	1644	1618	1538	1457	1379	1255	1186	1080	1057	1038	993	
2290	2154	2096	2021	1761	1683	1657	1577	1496	1418	1294	1225	1119	1096	1077	1032	
2309	2173	2115	2040	1780	1702	1676	1596	1515	1437	1313	1244	1133	1115	1096	1051	
2419	2233	2225	2150	1890	1812	1786	1706	1625	1547	1423	1354	1248	1225	1206	1161	
2497	2361	2303	2228	1968	1890	1864	1784	1703	1627	1501	1432	1326	1303	1284	1239	
2499	2363	2305	2230	1970	1892	1866	1786	1705	1629	1503	1434	1328	1305	1286	1241	
2530	2403	2345	2270	2010	1932	1906	1826	1745	1669	1543	1474	1348	1345	1326	1281	
2551	Tigre.															
2611	Parinano.															
2666	Elvira.															
2681	San Pedro.															
2696	Orarinas.															
2771	Boca del Hualaga.															
2843	Santa Cruz.															
2855	Playa de Tabatina.															
2883	Santa Maria.															
2901	Santa Rosa.															
2909	Yurimaguas.															

RIVER AMAZONS, from PARA to YURIMAGUAS in PERU. By LLEWELLYN NASH, ESQ.

	Lat. S.	Long. W. Rio.
Pará .. .. .	1° 27'	5° 20'
Praíha .. .. .	1 48	10 18
Santarem .. .. .	2 24	11 33
Obidos .. .. .	1 55	12 21
Serpa .. .. .	3 8	15 16
Manãos .. .. .	3 8	..
Coary .. .. .	4 6	19 57
Teffé .. .. .	3 21	21 31
Fonte Boa .. .. .	2 31	22 58
Tonantius .. .. .	2 52	24 37
S. Paulo .. .. .	3 27	25 47
Tabatinga .. .. .	4 14	26 46
Loreto .. .. .	3 49	27 3

Coary.		Loreto .. .. 3 49 21 3															
96	Balieiro.																
123	27	Teffé.															
144	48	21	Caysara.														
285	189	162	141	Araras.													
309	213	186	165	24	Fonte Boa.												
495	399	372	351	210	186	Tonantins.											
622	526	499	478	337	313	127	S. Paulo.										
706	610	583	562	421	397	211	84	Caldeirão.									
778	682	655	634	493	469	283	156	72	Tabatinga. Frontier of Brazil.								
781	685	658	637	496	472	286	159	75	3	Leticias. „ Peru.							
825	729	702	681	540	516	330	203	119	47	44	Loreto.						
951	855	828	807	666	632	456	329	245	173	170	126	Mancallieta.					
990	894	867	846	786	671	495	358	284	212	209	165	39	Pebas.				
1009	933	886	865	724	690	514	377	303	231	228	184	58	19	Porto Charles.			
1119	1043	996	975	834	800	624	487	413	341	323	294	168	129	110	Yquitos.		
1197	1121	1074	1053	912	878	702	565	491	419	416	372	246	207	188	78	Boca del Ucayali.	
1199	1123	1076	1055	914	880	704	567	493	421	418	374	248	209	190	80	2	Nauta.
1239	1163	1166	1095	954	920	744	607	533	461	458	414	288	249	230	120	42	40 S. Regis.



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AFRICAN EXPLORATION FUND.

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# AFRICAN EXPLORATION FUND.

AUGUST, 1877.

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PATRON, H.R.H. THE PRINCE OF WALES.

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MEETING AT THE EGYPTIAN HALL, MANSION HOUSE,  
JULY 19TH.

WITH a view to making more widely known the objects of the AFRICAN EXPLORATION FUND, the Committee, by permission of the LORD MAYOR, held a Public Meeting at the Mansion House on Thursday, July 19th, at 3 P.M. The objects of the Meeting were fully explained in the following letter addressed by the President to the Editor of the 'Times,' and published in the issue, July 17th, of that paper.

SIR,—On Thursday next, the 19th, a Public Meeting will be held at the Mansion House, the Lord Mayor in the Chair, in aid of the "African Exploration Fund," recently commenced by the Council of the Royal Geographical Society, to promote the continuous and systematic Exploration of the Interior of Africa.

The enlightened efforts of the King of the Belgians to give a fresh impulse to the exploration of Africa—especially the central part of the Continent—and to organise means by which the energies and sympathies of all the civilised nations of the world might be combined in furtherance of a common object, have met a ready response from all the capitals of Europe. The first result of the deliberations of the Conference held at Brussels last autumn, when representatives from all the chief nations and their Geographical Societies took part, was the formation of an "International Commission" for the Exploration and Civilisation of Central Africa. In connection with this it was further determined that each nation willing to co-operate should form National Committees to collect subscriptions for the common object, and send Delegates to the Commission, thus centralising as much as possible the efforts made, and facilitating by co-operation the execution of the resolutions of the Commission.

Belgium was the first to establish a National Committee, and the

appeal made by it, in November last, to the Belgian public for subscriptions, met with great success. At the Meeting held last month, at Brussels, of the International Commission of the African Association, it was reported that, in addition to a capital subscribed for investment, amounting to some 300,000 francs, the interest from which was to be available, the annual income for employment would be over 73,000 francs for 1877, with every probability of increase each succeeding year. From other countries Reports were received that National Committees to co-operate with the International Commission had been formed; in Austria, under the presidency of the Archduke Rudolph, the Prince heritier; in France, President, Count de Lesseps; Italy, President, the Prince of Piedmont, the heir-apparent; in Spain, President, the King; Russia, with the Grand Duke Constantine as President; Holland, President, the Prince of Orange; Portugal, President, the Duke of San Januario; Switzerland, President, M. Bonthelie de Beaumont. At Berlin, in response to the views of the Brussels International Conference, a National Committee was also formed in December last, under the title of the "German African Society," the functions of which will be to carry out the same objects as the International Commission, viz.—1. The scientific exploration of the unknown regions of Central Africa: 2. The opening-up of Central Africa to civilisation and commerce; and 3, as ulterior object, the extinction of the slave-trade. This last, it is to be observed, was also on the programme of the International Conference. As with the Belgian Commission, a leading feature of the German operations will be the establishment of stations, which are to serve partly as bases of operations for travellers, and partly as centres for the spread of civilisation and commerce. The German Emperor has given to the new Society 25,000 marks from funds at his disposal, and hopes are entertained of an annual grant from the Budget. The Cortes of Portugal, some time ago, voted 20,000*l.* for the expenses of an Expedition to the Congo: while the Italian Geographical Society, aided by the Government and the Italian public, has already devoted more than 200,000 francs to enable the Marquis Antinori to carry out successfully his Expedition to the south of Abyssinia, *en route* to Central Africa and the Great Lakes. Thus earnestly, and simultaneously, the work of exploration is being prosecuted, both from the Eastern and Western coasts by several nations, and it cannot be long before many others will be equally actively engaged. A communication from New York has also been received, showing equal willingness to co-operate, and thus combining the efforts of the New with those of the Old World.

The part which Great Britain is to take in this great movement cannot be a matter of indifference to the nation that has hitherto held a leading position in the exploration of Africa, whose travellers have discovered in the present generation the sources of the Nile, and done more than all other nationalities combined to make known to the world the interior of Central Africa and the great Lake region within the last twenty years, as the sketch-map, accompanying the circular of the African Exploration Fund Committee just issued, plainly shows. The commercial and colonial interests and the territorial possessions in Africa of this country are larger than those of any other European Power, while the suppression of the slave-trade and the advancement of missionary labours have been objects of national concern for more than half a century.

It was the natural desire, therefore, of the British members, geographers, and others invited to the Brussels Conference, to take part in the International Commission, and to co-operate with it in furtherance of the excellent purposes set forth in its programme, notwithstanding some obvious difficulties touching international questions and territorial rights. But the Geographical Society could not, by its constitution, enter upon any field of operations other than that of exploration. Commercial enterprise, suppression of the slave-traffic, and missionary or other civilising agencies, will all profit by any progress in systematic and continuous geographical exploration. But these are objects out of the province of a Geographical Society, and must be pursued by independent agencies.

In view of these insuperable obstacles to a combined action with and through the International Commission, it has been determined to move in the same direction, in accord and correspondence with the various national associations and the International Commission at Brussels, in so far as the objects of exploration are common to all, in such manner as to assist mutually, and avoid any waste of force and resources by duplicating the lines of exploration or unnecessary interference. Eventually it may be possible also to contribute to the funds of the International Commission, in further token of sympathy and cordial wishes for the successful attainment of its larger scheme of philanthropic exertion.

The Council, therefore, finally resolved that the best course of action for the Royal Geographical Society to pursue was to assist, by a grant from their own income and other steps, in the establishment of a national fund, to be called the "African Exploration Fund;" this fund to be devoted to the scientific examination of

Africa, the physical features and resources, the best routes to the interior, and all such other matters as may be instrumental in preparing the way for opening up Africa by peaceful means.

To the public the Council and their Exploration Fund Committee naturally appeal for support, since it is only by a command of considerable funds, far beyond the resources of the Geographical Society, that any systematic and continuous exploration can be successfully conducted in Africa. This is the object of the Public Meeting, which will be more fully set forth at the Mansion House on Thursday next by several distinguished speakers, whose interest in a more systematic and effective plan of geographical exploration than has hitherto been possible, and in the results such efforts are calculated to bring about, for the benefit alike of the African race and the civilised world, has induced them to promise their assistance on that occasion.

I am, Sir, yours very truly,

RUTHERFORD ALCOCK.

1, Savile Row, July 16.

*To the Editor of the 'TIMES.'*

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There was a good attendance at the Egyptian Hall, Mansion House, on the day named; the following noblemen and gentlemen being noticed, among others, as present:—His Grace the Archbishop of York, Right Hon. Lord Cottesloe, Sir Harry Verney, Bart., Sir T. Fowell Buxton, Bart., Sir Henry Barkly, K.C.B., Sir Rawson W. Rawson, Mr. S. Morley, M.P., Rev. Dr. Moffat, Mr. Donald Currie, Mr. R. N. Fowler, Mr. Francis Galton, F.R.S., Commander V. L. Cameron, R.N., C.B., Colonel J. A. Grant, C.B., Capt. Foot, R.N., Professor Tennant.

SIR RUTHERFORD ALCOCK, in opening the proceedings, explained that, owing to the detention of the Lord Mayor elsewhere on important duties, he had been requested temporarily to take the Chair himself. He also stated that Mr. Forster, to his great regret, was unable to attend and move the First Resolution, which stood in his name, he having been appointed upon the Committee of Inquiry at Christ's Hospital. He had hoped that Sir Samuel Baker would have been able to be present, but he had written from Devonshire, expressing his regret that, owing to an important engagement, he was prevented from coming to give his views on the subject to the Meeting. They were, however, to be congratulated on the presence of several distinguished travellers and speakers; and he trusted the Meeting would have laid before it so complete a statement, that it would know entirely the aim and scope of the effort that is now being made on the part of the Geographical Society. The object of the Meeting was in effect to call attention to the great movement now in progress all over Europe for the further exploration of Africa, to the present

efforts of the Geographical Society, and also to the importance of Great Britain taking its appropriate part in this great work. The increasing interest of the public, not only in African exploration and in the progress of African discoveries, but in the great results to which these are plainly tending, the Geographical Society has had many opportunities of testing during the past Session. When Captain Cameron came home last year after his marvellous tramp across the whole breadth of Africa, the reception he met with showed what intense interest the public felt in his heroic journey. Mr. E. D. Young, who launched the first steamer on Lake Nyassa, also gave to the Society a paper during the past Session recording what he had seen; as also the Rev. Roger Price, who, with a large South African experience, determined to test the possibility of driving bullock-waggon from the East Coast into the interior, and successfully carried out his experiment. In spite of the terrors of the tsetse fly, he found a practical road up to the highlands of the interior, a distance of 200 miles; and we now see that the highlands and the Lake region may be approached without spending weeks in that malarious belt of low ground that skirts the coast, in which many expeditions have been wrecked, some of the members having died, and others having lost their health. On each of these occasions the greatest interest was manifested, and there was no doubt that few explorations have been so manifestly fruitful in great results as African discoveries. Religion, civilisation, and commerce, are all involved in those explorations, which are, in truth, only the first of a large series of beneficial advances. It is the first step towards the opening up of Central Africa, or of any progress there of civilisation, of commerce, or of any efforts to spread the blessings of Christianity. It was that fact mainly which gave interest to these explorations, and it was on that ground that the Society appealed in this Hall to the greater public beyond, to take into serious consideration how much has been done for the African within the last twenty-five years, and how great are the results which the harvest promises if we only persevere in connection with the great movement now going on throughout Europe. No one can say how much may be achieved in another few years. Not only may the scourge of slavery cease by the influence of legitimate commerce and the progress of civilisation, but a new market may be opened up, of almost unlimited capacity, for our manufactures. Our country has become the great workshop of the world; and this metropolis is the great banking-centre, in which are set on foot enterprises extending to every quarter of the globe. All, however, is dependent very much upon our finding new markets to take our products in exchange. Our power of production is so vast, and goes on increasing so rapidly, that our best hope of continuing that prosperity, which makes us at once so rich and powerful, lies to a great extent in the possibility of opening up the vast regions of Africa, where millions of barbarous or semi-civilised people are ready to become customers, if they see the means of exchanging the products of their own fertile lands for our manufactures. Central Africa is capable of supplying, as Capt. Cameron has told us, the whole world with cotton and sugar, and nearly every other tropical product. All that is required is that there should be, as a first condition, peace—something of security for the fruits of labour. Now, our travellers who have come home of late years have all unanimously told us, that they have passed through many depopulated regions which had been known in Livingstone's time to be populous and full of industrious races, all willing workers, but which districts were now given over to the jungle and the wilderness, simply on account of the massacres that take place from year to year, in the slave raids made by Arabs and others, at a cost, it has been estimated, of from 50,000 to 100,000 lives annually.

Some of the narratives that we have heard are too horrible to contemplate

without an effort to put an end to such atrocities. One he remembered distinctly, when Dr. Livingstone was watching a great market on the banks of a river, where were congregated a large number of men, women and children, who had brought their produce in order to exchange it. Suddenly shots were heard. Some of these Arab slave-hunters had fired in among the unoffending people. All their produce was thrown down, and there was a great stampede; the Arabs kept firing volleys, and even shot them in the river while they attempted to escape. There was a great slaughter, and they probably captured 50 or 100, after slaying five or ten times that number. It is in this way slave-hunts were conducted. Industry and cultivation were impossible where there was no security. We are assured by all travellers that it only requires the presence of a few Englishmen and others—who have but one desire, which is to carry into the interior the benefit of civilisation in a humane and Christian spirit—to develop industry, and improve the condition of those naked savages, at the same time that they take into consumption that which we have in superabundance. Surely no Christian nation, apart from mercantile or commercial considerations, can possibly have a more powerful incentive to earnest action,—and if all the other nations of Europe are moving, as they are now, in this direction, and see sufficient motive, both in a philanthropic and commercial point of view, to take such an active part, Great Britain, which has hitherto taken the lead in everything connected with the African people and African discoveries, cannot be the only nation to remain behind. We must, however, have public support and sympathy; because this is a national concern. The King of the Belgians, with his usual enlightened philanthropy, last autumn collected the chief geographers of all nations, and travellers in Africa, in order to consult with them as to how the whole of the civilised world could best combine in a great philanthropic effort to put down the slave-trade, and to open up Central Africa to commerce and civilisation. The result has been the formation of national committees and associations in nearly every capital in Europe. There has been a hearty response from St. Petersburg to Lisbon; large sums of money have been contributed and are now being daily subscribed. The Emperor of Germany has given from funds at his disposal 25,000 marks. Belgium alone, in loyal response to its sovereign, immediately raised a capital of 300,000 francs, and has provided an increasing income, which already reaches nearly 75,000 francs. In Spain, the King himself took the lead, and determined, if necessary, to undertake some expedition, even at his own expense, if he could not find funds from among his people. In Portugal and France, and even in the United States of America, there has been a cordial and hearty promise of co-operation. The object of the appeal now made by the African Exploration Committee is to induce the British nation and the public throughout the British Empire to recognise the importance of this movement. Its simultaneous and generous character ought to show that we, who have chiefly by our discoveries opened up the central regions of Africa, only require a little further perseverance to have tramroads and access to the great inland seas. Mr. Price, with his bullock waggons, is only the pioneer of tramroads and railroads. There is already a scheme for a telegraphic line through Africa, from north to south. The Khedive of Egypt has established one as far as Khartum, and has had a survey prepared to carry it on to Gondokoro, and the vicinity of the Victoria and Albert Nyanzas. In the southern colonies we have a telegraph up to the edge of the Transvaal, which, now that it forms part of the British Empire, will soon see an extension of the line. There is thus nearly two-thirds of the work done, and it only requires a continuous effort to unite the two termini, and then Cape Colony and all intervening stations and points would be in communication with each other and Europe. This was no speculative dream, but a sober reality, lying straight before them. For what had been done in the last

quarter of a century by desultory or isolated and uncombined efforts, leads us to form well-founded hopes of what may be done in the future by more systematic effort and organisation. When Dr. Livingstone commenced his career as a discoverer, after being driven from his Mission Station by the Boers, the whole map from the upper portion of the Nile nearly to the Cape Colonies, with the exception of the coast, was a blank. Since that time not only have the sources of the Nile been discovered by Burton, Speke, and Grant, who have done so much to make their names illustrious as travellers, but Captain Cameron has traversed from east to west, and made a journey almost unexampled in the history of exploration. And there is reason to believe from Cameron's late accounts, that when we further pursue our explorations, and know what is the course of the Congo and Lualaba, there may be a means of uniting, by a canal, the great watercourses from the Eastern Coast to the Atlantic. Surely these were great and worthy objects of national concern, and such as are fully deserving of public sympathy and support! But it is not reasonable to expect that the public, or even this great metropolis of the world, with all its vast interests connected with commerce and the colonies, should move in the matter until they were fairly and fully brought before them. The African Exploration Fund Committee naturally came first, therefore, to the City of London, in order to feel the great pulse of the nation, especially in connection with the large commercial, colonial, and maritime interests that are involved in this plan of exploration. We had become great and powerful, chiefly by our commerce and our colonies, and it was only by keeping steadily in view the means of further development, and by finding new markets for our manufactures, that we could hope to maintain the position we now hold.

Sir RUTHERFORD ALCOCK concluded by moving the following Resolution:—

That the commercial interests of this country are to a large extent involved in the development of intercourse and legitimate trade with the outports to the fertile but little-known regions of Central Africa; and therefore that the scheme of thorough exploration proposed by the African Exploration Fund Committee, deserves the warmest support of this Meeting as powerfully tending to secure that end.

Commander V. L. CAMERON, in seconding the motion, said, from his experience of Africa he had found it to be one of the most fertile countries in the world. There was an archipelago in the East called the Spice Islands, but Africa might be designated a spice continent. Down the valley of the Lualaba he had walked for a long distance under the shade of nutmeg-trees, and the ground was literally covered with nutmegs, which were not like those grown in Ceylon, but were really useful as articles of commerce. He had also picked up a few on the eastern shores of Lake Tanganyika. Rice, corn, and all the products of a tropical country could be grown, he might say, in all the districts if there was proper cultivation. On very many of the high plateaux wheat had been cultivated to a certain extent by the Arabs, and the grain which was produced there might be exported from the East Coast of Africa to our Indian dominions, and this would in a great measure obviate those Indian famines of which so much had been heard. In Africa there was generally a much greater amount of produce than the people could possibly consume. A great deal was heard about the embarrassment of armies, and the great difficulty

there was in feeding them; but in many of the comparatively barren countries in Africa it was a common thing for large caravans to pass through a district with 4000 or 5000 inhabitants, who, without any idea of commissariat, could easily provide provisions for a week or ten days for all that passed through. As the goods, however, that were given in exchange had to be carried on the men's shoulders, the price of the transport was greater than in civilised countries. This showed the power of maintaining life in Africa. There was also an ivory and a copal trade at Zanzibar, and there was coffee not only at the West Coast, but it was growing wild in the centre of the country. In 1875 the exports of india-rubber amounted to 40,000*l.*; in 1876, 100,000*l.*; and this year they were expected to reach 250,000*l.* This was owing to the Sultan of Zanzibar having diverted some of the capital of his subjects and the people residing in his dominions from the slave-trade. All these articles of commerce would no doubt be brought within easy reach if some systematic plan of exploration were resorted to. This systematic exploration must be one of the first steps towards the opening up of the continent to missionary work, to commerce, and to civilisation. All these three should go hand-in-hand, and there should be no jealousy between the missionary and the trader, because as the missionary forced his way inwards, and increased the wants of the people by educating them, so would the trader find a more ready market for his wares. The slave-trade was something more horrible than anybody could possibly imagine. He had seen an unfortunate woman, unable to walk, lashed to a pole, and being carried towards the home of her purchasers; but as those who carried her thought they would not be able to do so much farther, they threw her, still lashed to the pole, on the roadside, ready to take her chance of being devoured by wild beasts. He had known of ten or twelve villages, with a population of 500 or 600, being depopulated in order to furnish a wretched string of 50 or 60 slaves, and all the rest of the inhabitants of these villages, if not killed there and then, had to fly into the jungles and die of starvation, or fall a prey to the wild beasts. This was the sort of thing which went on from day to day. The question of domestic slavery, therefore, was one which must be approached with some caution. It was ingrained in the whole of the native population of Africa, and would only die out by the gradual education and civilisation of the masses. The slave-trade ought to be a source of burning shame to every civilised being who did not help to put it down by systematic exploration. When the roads were opened, and bullock carts introduced as Mr. Price was doing now, the men would no longer be turned into beasts of burden, and in a few years there would be tramways up to the great lakes; and the unparalleled system of water-communication in the centre of Africa being utilised, the whole of the interior of the continent would be opened up to civilisation and trade. While at home there was depression in the maritime and commercial world, there were in Africa—one of the richest producing countries in the world—besides its vegetables, gold and diamonds, silver and copper mines, and it merely wanted enterprise to go into the centre of Africa to get them. The natives, if they saw any chance of adopting a settled form of living, would be only too glad to do so, and in two or three years it was possible to form a nucleus, round which would gather a large and settled population. Even the slave-traders, when they settled in the interior for two or three years, formed the centre of a large settled population whom they are wise enough not to disturb, because they furnish them with men and food to enable them to go on their slave-hunting raids. But if the centre was proceeded to direct, and a station was there formed with a certain code of laws to govern it, there would immediately be found a large native population. This showed that many of the stations that might be formed for the sake of systematic exploration, would be almost immediately self-supporting. At the same time the commencement of the work was necessarily a costly one. He called upon the



Meeting to support the motion, and to do their best to render it a practical success.

Vice-Admiral E. OMMANNEY, as a representative of the Society for the encouragement of Arts, Manufactures, and Commerce, which numbers over 3000 members, wished to express their desire to aid in promoting the movement. In the African Section of the Society of Arts, a series of valuable papers had been read by a number of London and Liverpool gentlemen, all showing the great desire they had to enter into commercial transactions with the interior of Africa. The missionary and the traveller had already done their duty, but he thought the missionary would soon come to a standstill unless he was backed up by the merchant and the agriculturist. With civilisation the African requires to be taught habits of industry, the missionary should be accompanied by the mechanic with a view to promote the great object of improving the African.

The LORD MAYOR, who at this juncture entered the room and took the Chair, put the Resolution to the Meeting, which was unanimously adopted.

His GRACE the ARCHBISHOP OF YORK moved :

That the history of the Slave Trade during the last three centuries, and the crimes yearly perpetrated in its maintenance at the present day, render it imperative on all nations who have ever profited by this trade to adopt the most effective means for its suppression ; an essential preliminary to which is a systematic effort, such as is now proposed, to obtain further information regarding the less known regions of Central Africa, and ascertain the best routes thereto from the coast.

He referred to the successful efforts that had been made by England to suppress the slave-trade generally, and said that, on the whole, the West Coast of Africa was free, in consequence of the endeavours of England, from the curse which had once devastated it. It was not so, however, on the East Coast, for, after a hundred years' expenditure of toil and treasure, he was obliged to state that at the town of Quiloa, not far from Zanzibar, there were exported annually about 20,000 slaves, which were brought from the west side of Lake Nyassa. Having described the mode in which the slave-trade was carried on, he stated that for every thousand slaves, arrived at their destination and set to labour, 1450 perished on the way, apart from the torture that was inflicted upon those who were preserved. There was a certain treaty between this country and the Sultan of Zanzibar, by which, although the slave-trade was abolished, slavery was recognised as a domestic institution ; but, without urging any private sentiments of his own, he thought that the less this country had to do in future with such treaties the better. A certain number of slaves had to be provided every year to supply the needs of the territory of the Sultan, and the number required for that purpose might not possibly amount to 4000, or even half that number, and therefore if 20,000 were exported from Quiloa under the treaty, the remaining 16,000 went elsewhere, and were exported in defiance of the other part of the treaty, which forbade slavery upon the seas. How was this to be dealt with ? He thought that the line that was being adopted was at least a thoroughly practical one, namely, the opening up of roads throughout Africa. It was a country full of

fertility and riches, and if commerce could be planted there, the slave traffic would wither away of its own accord. It was necessary that a practical nation like Great Britain should have fuller information as to the country they were dealing with. They should not stop short until the continent of Africa was traversed in all directions by great highways. It would thus give up all its riches, and the commerce of London would not fail to profit greatly by such a result; and on the other hand it would receive freedom and justice, which would become the law of these dark communities, and the crimes which now offended Heaven so grossly would disappear before the light which the explorers would be able to carry in their hands.

Sir T. FOWELL BUXTON said he had great pleasure in seconding the Resolution, because he felt that it contained within it the doctrine that it was the duty of all civilised nations to join together, as far as may be, not only in putting an end to the slave-trade, which had been so long a grievous disgrace to the globe, but in introducing civilisation and honest commerce where nothing but rapine and ruin had prevailed. It was worthy of remembrance that along the Eastern Coast of Africa the slave-trade had not at all times prevailed. When the Portuguese first surrounded the Cape and extended their explorations to the north, they did not find any savagery prevailing, but a succession of flourishing towns filled with inhabitants, carrying on a large and flourishing trade with the coasts of India, Arabia, and Persia. In course of time, however, in consequence of the slave-trade which was by them introduced, that state of prosperity was destroyed, and for many years past there had been but little legitimate trade in that district. He could not help thinking, however, that that state of prosperity was about to be re-established, and it would be re-established, if at all, by the concurrent exertions of Europeans endeavouring to introduce higher thoughts and ideas to the natives, and at the same time the advantages of legitimate commerce. It had already been brought to notice by Sir Bartle Frere that there were round the coast a great number of Indian traders dealing with European traders, and who were perfectly prepared to take the part of middlemen. He could not but hope that the figures as to the loss of life which attended the slave-trade were rather those which were true a few years ago, and that they were not true at the present time. He thought it must be acknowledged that the Government had done a great deal in the past towards the suppression of the slave-trade. They had maintained for many years a large number of ships, and had exerted themselves by the arrangement of treaties and by placing various authorities along the coast. He thought the hearty way in which the treaty had been carried out by the Sultan of Zanzibar, and the great services in this respect that had been performed by Sir Bartle Frere, ought everywhere to be acknowledged; and to Consul-General Dr. Kirk was due very much of the measure of success which had attended the efforts of the Government. The missionary societies had also done their part, and, while not neglecting their own great work, had done a great deal of sheer material labour, which must tend to the civilisation of the countries to which it was applied. They were at present engaged in the very kind of exploration for which the assistance of the public was now asked. One party had reached the great Victoria Lake; another party was on the point of reaching Tanganyika, with the intention of establishing a civilised settlement on the shores of those lakes. They had already constructed over 100 miles of road, and the time was not far distant when there would be steamers plying up and down, and an impulse would be given to everything that would tend to legitimate trade and the spread of civilisation. He thought the time had now come when the commercial interests should do their part also in assisting to open regular communications into the interior of Africa, as such a communication would be of great benefit to the commercial interests of the whole of England.

Dr. MOFFAT, in speaking to the Resolution, alluded to the long connection he had had as a missionary with the interior of Southern Africa, and pointed out the claims of the Royal Geographical Society to be heard on such a subject, owing to the important part it had played in opening up the interior of Africa. He described the country, in which he had lived so long, as being very populous and fertile, and the inhabitants as being intelligent, capable of being taught and of teaching others, and of rising in social well-being. There were those who held that civilisation should come first, and evangelisation afterwards; but he held the opposite view, and thought the Gospel should be introduced wherever the Royal Geographical Society had laid open the country. There were missionary stations connected with the Bechuana Mission, through which passed 250,000*l.* worth of European manufactures every year, and this was the result of missionary labour, and of the efforts of the Royal Geographical Society.

Dr. LEARED, who had lately returned from a visit to the Court of Morocco, said that that country and its position in relation to the exploration of Africa attracted far less attention than it deserved. This arose mainly from the well-known fanaticism and desire for isolation of the Moors. He believed that if a well-organised caravan of from one to two hundred members, officered by Englishmen, was sent from Morocco to Timbuctoo, a vast accession would be made to science and civilisation in general, and that it would tend to the suppression of an extensive slave-trade. Such an expedition would not be very costly, and might, by means of trade, be made partly self-supporting. It was declared by people in Morocco that the Sultan would never allow a caravan of the kind to leave his dominions. But when the matter was brought under his Majesty's notice, he not only offered no opposition, but issued an edict to ensure Dr. Leared's safety wherever his Majesty's power reaches.

The Resolution was then put and carried *nem. con.*

Mr. S. MORLEY, M.P., moved,—

That this Meeting views with satisfaction the continuous and earnest efforts of the several Missionary Societies in this country, following in the footsteps of Livingstone, to spread the humanising influence of Christianity in Africa by the establishment of permanent Mission Stations in the distant interior, and considers the scheme of the African Exploration Fund Committee to be a powerful auxiliary, as tending to open up new fields for their labours.

In doing so he expressed a hope that the citizens of London would respond to the appeal made by the Royal Geographical Society. Fresh markets were wanted owing to the excessive competition that now existed among European manufacturers. There could be no doubt that if highways were opened up in the interior of Africa, and the means of easy communication were found, there would be a large increase in the demand for our manufactures in that country, and there would be more facilities for exporting African products. These were motives not only for giving expression to mere sentiment or sympathy, but for subscribing liberally to the scheme. He believed that commerce ought to be the forerunner of the missionary. He meant by that that the means of communication ought to be pushed through the energy and perseverance and determination of British traders, so that there might be an easy access for those who went on a higher mission—that of spreading, not the

interests of mere denominational churches, but the purifying and refining influence of Christianity. He thought that the investment they were called upon to make would be largely productive of good in many ways, and he was ready himself to take his share in the undertaking. By letting in light into the centre of Africa, an end would soon be put to the deeds of darkness which so long had distressed all the friends of humanity. He did not wish to push forward his name unduly, but he would gladly subscribe 50*l.* a-year so long as the Society continued its work.

Mr. E. HUTCHINSON (Secretary to the Church Missionary Society) seconded the Resolution. He said with regard to the opening up of Africa, Missionary Societies were taking possession of the eastern portion of the interior, and they were already at work. At the present moment he had reason to believe that one hundred miles of good road had actually been cut, through the agency of the Church Missionary Society, from the coast up to the highlands of Eastern Africa; such a road as would permit the passage of the bullock-waggons which he hoped would soon follow, accompanied by Mr. Price, the missionary of the London Missionary Society. The London Missionary and Church Societies had in an amicable way agreed to divide the land between them. The former were taking Lake Tanganyika and the central parts lying around it, and would probably include the Lualaba and the interesting region Captain Cameron had alluded to. The Church Missionary Society were to take possession of the Victoria Nyanza and the Albert Nyanza. For this purpose a party had been sent out, and as it had been held for some considerable time that the making of a good road across that portion of the African continent, which was a region of swamp and malaria and fever, was a necessary preliminary, not only for missionary work, but for the opening up of the interior of Africa, the Church Missionary Society considered they were justified in apportioning part of the sum of 15,000*l.*, which was placed in their hands for the purpose of making this road. They would offer it to the Geographical Society, to the London Missionary Society, and to all those who would penetrate Africa in the spirit of the present scheme. Some of the party had reached Victoria Nyanza, and had launched probably the first steamboat that had ever rested on its waters. Their presence would, he hoped, give support to King Mtesa of Uganda, to stand up against the oppressions of Egypt. It seemed to him that the Meeting was called upon to review and express its pleasure in the work of Missionary Societies; and on that account it would be interesting to know that there was one society able to grapple with Africa from west to east. Referring to the west side of the continent, he said that, under the auspices of Bishop Crowther, the Church Missionary Society hoped to penetrate the other part of the continent. In order to do this, they had given orders for the construction of a steamer to carry their mission to the Upper Niger or Benue, and from thence the attempt could be made to penetrate to its sources; and if their theory was correct, that would bring them to within one hundred miles of the spot where Livingstone left Lualaba. He might give, as an example of the shrewdness and activity of the missionaries of the Church of England, the trade which was now carried on at Lagos. Missionary Societies and missionary agencies were at this moment exerting on behalf of the victims of the East African slave-trade that kind of protectorate which England formerly delighted to exercise, and the Christian Missionary Society had agreed to devote some of their money in feeding and clothing those whom the Government had put into their hands as rescued from the slave-trade. On the part of the Missionary Societies, he could say that they looked with pleasure and thankfulness upon the great movement. Wherever the geographer went and could show a fair field of labour, those who took upon them the missionary calling would not be slow to accept the challenge and to follow in their wake. On the West Coast they had to deal with the curse of rum and gunpowder everywhere, and what

Missionary Societies earnestly wished was that such an association as the one contemplated should take into its hands, and guide and lead the introduction of trade and commerce, and enterprise and geographical research, wherever it went into Africa.

Mr. LOVELL said he had had thirty-eight years' experience in Africa, and had visited and traded with every settlement from the river Gambia down to the West and South Coast. He cordially agreed with the object of the Meeting, but gave it as his opinion that it would be impossible for any commerce to be carried on in the interior of Africa without Government aid and protection.

The Resolution was then put and carried,

Sir H. BARKLY proposed :—

That the opening up of Central Africa by Geographical exploration, especially on its Eastern side, is of great importance to our South African Colonies, and our possessions in Western India, as having for one of its prospective results a large development of commercial activity between the respective countries.

He said that from his experience, as Her Majesty's representative in South Africa, he was convinced of the great importance, in a commercial point of view, of opening up the interior of Africa. The exports from this country to South Africa had of late years very considerably increased, owing mainly to the discovery of diamonds, and the annexation of the Diamond Fields; but it was perhaps not generally known how large a proportion of the goods that were sent up to the Diamond Fields found their way into the remote interior by means of traders. Griqua-land had become one of the greatest emporiums of native commerce, and it was estimated that already there were annually sent out from that centre goods to the value of half-a-million sterling. That trade had nothing to do with the finding of the diamonds; but he believed that the trade would increase as British influence extended further and further towards the interior, and peace and order were established. The hoisting of the British flag on the Transvaal he considered as an event of national importance. Great Britain had thus extended her permanent authority beyond the tropical line, and with that authority he felt sure that a rapid increase of civilisation, commercial activity and greater facilities for geographical exploration were sure to follow. One of the first results would be to connect Pretoria with Cape Town by electric telegraph, which, doubtless, would eventually be extended to Livingstonia. He was glad to observe that one of the recommendations of the Geographical Society was to connect the Gold Fields, by crossing the Zambesi River with Lake Nyassa. So far as the tribes south of the Zambesi River were concerned, he thought there would be no difficulty in obtaining their assent and assistance in protecting the line. The principal chiefs had been in the habit of communicating with him, as Her Majesty's High Commissioner, either for the purpose of forming close alliances or of being brought under British rule; and now that the Transvaal had been annexed, and Sir Theophilus Shepstone, whose name was known and respected throughout all Southern Africa, had the administration of the Government, he thought there would be no difficulty in getting them to accede to any proposal that might be made to them. With regard to the tribes north of the Zambesi he could not speak, but from travellers who had been there recently he had every reason to believe that our influence was very considerable and would rapidly extend. No doubt as long as the slave-trade existed obstacles would

be thrown in the way by interested parties; but he earnestly hoped that the days of that accursed traffic were over, and of this he thought they might be perfectly confident that as the British frontier advanced the slave-trade would recede.

Colonel J. A. GRANT, in seconding the Resolution, said that the account given of the natives of the south by Sir Henry Barkly was very encouraging to him (Colonel Grant), who had seen the people in the north. The races he found from the Eastern Coast to the Victoria Lake were always willing to allow travellers to pass through their country who paid taxes. If proper men, accustomed to deal with natives, were selected, undoubtedly great benefit would result, not only to Africa but also to England and Europe, by opening up the great trade routes which were now hidden. The most important route, as Sir H. Barkly had stated, was from the Gold Fields right up to the north, leading to the country which Captains Burton and Speke were the first to enter from the east, and would branch off to Lake Tanganyika. The ridge extending from the Gold Fields was very lofty, being some 4000 and 6000 feet above the level of the sea, and the whole region was a splendid one. The second and almost next important route would be to the north end of Nyassa, continuing on to the most southern end of Lake Tanganyika. Another route was along the mountain range near the coast. A few travellers had gone through the mountain passes, but it was desirable to know how near the mountains approached the sea, and how far they receded from it, in order that high elevated posts might be fixed upon as future settlements, should they be required. Afterwards two or three other routes might be found to the Victoria Nyanza. The whole of the country required to be explored in order to find out the most healthy points where people might settle, and where steamboats might be placed to navigate each one of the lakes and collect the vast products of their shores. The natives were quite ready to barter with any one who would deal with them fairly and honestly. Wherever he and those who accompanied him went, the people along the route evinced great curiosity in seeing them, and showed cleverness and tact in the management of their affairs. They would, however, be greatly improved if they were taught agriculture, and the construction of wheeled conveyances, as cattle abounded. They only raised sufficient crops for themselves and families, and did not know what it was to trade in the numerous products of the interior. With regard to the telegraphic line proposed by Mr. Kerry Nicholls, as far as he (Colonel Grant) was aware, the people were perfectly willing that it should be constructed; and if the chiefs were subsidized, they would not only protect the line, but they would punish, probably execute, any one who attempted to destroy it. Sir Samuel Canning, the eminent engineer, had told him that there appeared no physical difficulty: the only difficulty was that of finance. At present there was no telegraphic communication from the Cape of Good Hope until the Cape Verde Islands were reached, and it took fifteen days to communicate from there to the Cape of Good Hope. If the Transvaal were to bring up their line to the Limpopo, the distance from that to Gondokoro would be 1500 miles, or a cost of 230,000*l.* for a single line of telegraph, against which there was at present an annual tax of 200,000*l.* for keeping a fleet of vessels upon the East Coast for the suppression of slavery. If a through line of telegraph were established, the Government would be able to strike at the root of all slavery, and save, not this annual outlay alone, but also be the direct means of saving the lives of at least one-third of the poor people who are captured as slaves in the interior. The Africans were really a fine people, and all who joined in this great effort to benefit our fellow-creatures by extending education to them would confer a substantial boon on the human race.

Mr. KERRY NICHOLLS, in supporting the Resolution, gave a detailed account of the scheme for the proposed line of telegraph overland from Egypt to the

Cape of Good Hope, as laid before His Majesty the King of the Belgians by Colonel Grant, Mr. Arnold, and himself at the Geographical Conference held at Brussels in September 1876. Beyond the advantages which would result to South Africa from the construction of this line, and the benefits which would accrue to the development of systematic exploration in Central Africa, the advantages and benefits that would result to the native races would be unbounded, for not only would the line form a powerful civilising agent, but it would at the same time serve as a very effective barrier against the slave-trade. England had a great part to play in the development and civilisation of Africa, and he could not but think that that portion of the continent selected by the Committee as the scene of its operations formed the keystone to the whole fabric. The Victoria Nyanza, Tanganyika, and Nyassa Lakes, by reason of their favourable situation and the undoubted advantages they afforded for extended water-communication, must eventually become the chief centres of settlement and trade. It was for the people of England to say whether the great work of the Exploration Committee would be consummated, and he did not hesitate to assert that those who supported the Committee in their endeavours would not only confer a great benefit upon this country, but a lasting blessing upon countless millions of the human race.

The Resolution was put and carried.

On the motion of Sir RUTHERFORD ALCOCK, a vote of thanks was accorded to the Lord Mayor for the use of the Egyptian Hall, and for his kindness in taking the Chair.

Mr. DONALD CURRIE proposed a vote of thanks to Sir Rutherford Alcock, which was unanimously carried.

Sir RUTHERFORD ALCOCK, in acknowledging the compliment, expressed a hope that, as a result of the Meeting, the aim and scope of the Geographical Society in regard to the scheme would be made widely known throughout the Empire, and that no nation in Europe or elsewhere would be allowed to assume the lead which England had so long taken with so much honour and credit in African Exploration. He trusted that the British nation, as well as the Royal Geographical Society, would always be ready and willing to co-operate with other societies which were aiming at the same common objects of abolishing the African slave-trade, and conferring upon Africa the blessings of civilisation and commerce.

The proceedings then terminated.

## MINUTE OF A CONFERENCE

*Held at 1, Savile Row, on Friday, the 8th of June, 1877,*

RESPECTING THE FEASIBILITY OF A LINE OF OVERLAND  
TELEGRAPH THROUGH AFRICA TO CONNECT THE LINES IN  
SOUTH AFRICA WITH THOSE OF EGYPT.

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SIR RUTHERFORD ALCOCK, Sir Henry C. Rawlinson, Sir Alexander Milne, Bart., Sir Douglas Forsyth, Sir Rawson W. Rawson, Sir John Kennaway, Bart., General Rigby, Colonel Grant, and Mr. Francis Galton, members of the African Exploration Committee, met to confer with Sir Samuel Canning and Mr. Robert Sabine.

Colonel GRANT proposed that the Meeting should consider the feasibility of constructing a line of telegraph overland, so as to complete a communication from Alexandria to the Cape, and the expediency of collecting and making public information upon the subject.

It was agreed among the members of the Committee that, although it was not their province to promote commercial or philanthropic undertakings in Africa, it was, nevertheless, quite within their province to express opinions on the geographical conditions, either physical or political, affecting such an undertaking, which might be brought under their notice. In the present instance, if Sir S. Canning and others would instruct the Meeting as to what was required for the construction and maintenance of a line of land-telegraph, it would be prepared to consider whether those requirements were likely to be supplied in Africa.

The information given to the Meeting was to the following effect:

The want of telegraphic communication between England and her Colonies in South Africa has long been felt. Since the discovery of the Diamond Fields in Griqua Land, and of the Gold Fields in the Transvaal, the need of it has become still more urgent. The recent annexation of the Transvaal Republic appears to render it almost a necessity. The importance of the Imperial interests



concerned in the successful administration of affairs in that newly-acquired territory promises to ensure from the Home Government, as well as from the Governments of the British Colonies in South Africa, the support of any scheme that may be shown to be practicable and prudent.

Hitherto attention has been turned only to the extension to the Cape Colony and Natal of the existing submarine cables. These have been carried from points in Europe, connected with England, as far as the Cape Verde Islands on the west of Africa, and to Aden on the east. Several attempts have been made to accomplish the extension of one of these lines to the Cape, but without success. The expense has been too great, and the subsidies offered by the Governments concerned have been insufficient.

To lay a submarine line from St. Vincent, in the Cape Verde Islands, to Cape Town will take about 4550 miles of cable, and on to Natal 1100 miles of cable; making a total of 5650 miles. This line would present the advantage of connecting the Islands of Ascension and St. Helena with England.

A direct submarine line from Aden down the coast to Natal, and thence on to Cape Town, would take about 4850 miles of cable. It would add about 500 miles to touch at Zanzibar and Delagoa Bay. But it has usually been contemplated to embrace in this circuit the important Colony of Mauritius, which would contribute a liberal subsidy, together with the British Islands of Seychelles, and the French Island of Reunion. The length of a line carried through these points to Natal and Cape Town would be about 5650 miles of cable. It is believed that the idea of a line from the Cape Verde Islands to South Africa has been abandoned in favour of this latter line. Sir S. Canning and Mr. Sabine stated that the cost per mile of a submarine cable, when laid, is about 170*l*. The estimate, therefore, of the shorter line would be about 850,000*l*., and of the others nearly a million sterling; and if duplicated, which is almost indispensable, the cost would be doubled.

The recent expeditions of Gordon Pasha in Upper Egypt, and the discoveries of chains of inland seas in Equatorial Africa, with the River Zambesi in the south and the Lualaba to the west, have lifted the veil which, until lately, shut out this vast tract from European eyes, and have opened up the possibility of running a line of telegraph through it—a scheme which not half-a-dozen years ago would justly have been treated as visionary.

At present a land line of telegraph exists between Alexandria, in lat. 31° N., and Khartum, on the Nile, in lat. 15° 36' N., a distance in direct course of 923 geographical miles. It has been proposed to

extend it to Gondokoro, also on the Nile, in lat.  $4^{\circ}54'$  N., a further distance of 642 geographical miles. This portion has been already surveyed. Its importance towards successfully maintaining the government of Gordon Pasha in Upper Egypt is so great, that doubtless the line will be constructed by the Khedive as soon as circumstances will permit; and the prospect of an extension southwards might even expedite the commencement of the work. It is believed that all tribute obtained by Gordon Pasha within his Government is to be applied to the improvement of the communication between the Soudan and Egypt, and not paid into the Egyptian Exchequer.

The total distance from Alexandria direct to Pietermaritzburg, the capital of Natal, which lies almost on the same meridian, in lat.  $30^{\circ}$  S., is 3660 geographical miles. The distance, therefore, from Alexandria to Gondokoro, which is 1565 geographical miles, is not far short of half of the whole distance.

In the south, a land-line exists from Simon's Town and Cape Town to Graham's Town and King William's Town, almost due east, a distance of 550 miles, with a branch from the former town of Kimberley, in Griqua Land, lat.  $28^{\circ}7'$  S., a distance of about 450 miles. From this a line carried direct through Pretoria, the present capital of the Transvaal Territory, to the Gold Fields, in lat.  $17^{\circ}5'$  S. which lie nearly on the same meridian as Alexandria and Pietermaritzburg, would be about 840 miles in length, and there would remain a line of only 1344 miles in direct course from Gondokoro to the Gold Fields to complete the line from Alexandria to Cape Town. It might be decided to carry this line through the Orange Free State and Natal, in the interest of those territories, but it would increase the length to some extent.

Taking the land-line from Kimberley to Khartum (2826 geographical miles) to cost, including transport and erection, as much as a submarine line, the total cost of the line would only be half that of a single submarine line.

If, however, the Cape Colony should extend their line from Kimberley through the Transvaal to Tete, and the Khedive continues his line to Gondokoro, the cost of the remaining section required to join these points would be about 230,000*l*.

The stages and connecting links on this line, according to our present knowledge of the route, commencing at Gondokoro, would be:—

1. M'tesa's Capital, north of Victoria Nyanza.
2. Ujiji, east of Tanganyika; with
3. Branch to Zanzibar.

4. Station on north side of Lake Nyassa, connecting either with Ujiji, or branch to Zanzibar, as may be found preferable.
5. Livingstonia, on south-east of Lake Nyassa.
6. Tete, or Sena, on River Zambesi; with
7. Branch to Quilimane, or mouth of Zambesi.
8. Leydenburg, or Gold Fields, in Transvaal; with
9. Branch to Delagoa Bay; and
10. Branch to Natal.

Beyond the first difficulty of the extent and commensurate cost of this line are two others: one, the heavy additional cost arising from the difficulty of transporting the materials; the other, the risk attending the construction and maintenance of a line of telegraph through a country inhabited by uncivilised tribes. The latter must be first dealt with, because, if it were as great as at first sight it might appear to be, it would be fruitless to endeavour to overcome the former.

To many it might appear an extravagant and chimerical undertaking to carry so recent a product of civilisation as a telegraph wire, and one so liable to injury, through the heart of a barbarous country like Africa, where explorers have hitherto been barely able to grope their way. Nevertheless, the more closely the matter is considered the less formidable are found to be the obstacles.

Experience has shown that lines of telegraph may both be constructed and maintained without injury (under ordinary conditions) in countries occupied by uncivilised, wild, and even hostile tribes. In the United States a line has been carried from San Francisco to New York, a distance of 3300 miles, passing over the plains of California, across the Sierra Nevada, through the desert of Nevada, over the Rocky Mountains at an elevation of 8400 feet above the sea, and thence through the prairies for 700 miles, through territories occupied by numerous Indian tribes, who, however, do not interfere with it. In fact, the wigwam of the savage may be seen side by side with the hut of the settler, who is rapidly following its course.

In South America a line runs from Buenos Ayres across the summit of the Andes to Valparaiso and Lima, a distance of 1100 miles. Another line runs from Buenos Ayres, through the centre of tropical Brazil, a distance of 1000 miles, to Sujuy.

With similar success, a line has been run across the continent of Australia from Adelaide to Port Darwin, a distance of 2000 miles, which was completed within exactly two years from the time of its commencement in August 1870. The difficulties of transport in

this case certainly equalled, if they did not exceed, those which are likely to be experienced in Africa.

These lines have been surpassed in length and in difficulties by that which crosses the Russian Empire from St. Petersburg to the coast of Siberia, a distance of 110°, or about 5000 geographical miles, through perhaps the most inhospitable and desolate country in the world.

The Russian lines through Central Asia are examples of lines carried securely through hostile tribes. But perhaps the most apposite instance is that of the Euphrates Valley line, which was successfully constructed, and has been kept up without difficulty, contrary to the expectation and predictions of some of the most experienced judges. It was found there, and has been generally found, that a line of telegraph can, with prudent and conciliatory management, and with very small subsidies to the chiefs through whose territories it passes, be maintained much more easily than might be expected. If this could be effected in the Euphrates Valley, among the wild and migratory tribes of that country, how much more promising is the prospect among the settled, and (when unprovoked) peaceable tribes in many parts of this African line!

Sir H. Rawlinson bears testimony to the success of the Euphrates line. A line has been successfully established in Beloochistan. Colonel Grant's personal experience leads him to believe there will be no insurmountable difficulty in South Africa. The expedition recently sent by the Church Missionary Society from Bagomoyo to Victoria Nyanza met with no obstruction. The experience of Bishop Crowther up the Niger leads him to the same conclusion. In fact, the erection of a telegraph line familiarises the natives with the power, as well as the presence, of Europeans. They become acquainted with its mysterious agency, and with the fact that no injury remains undiscovered, while the locality of it is at once known. Each stage is a step gained in advance, and the chain behind is kept up, visible and unbroken, unlike the track of travellers; while the communication with an unknown distance, to the natives equally far and near, holds them in awe. As a matter of universal experience they soon become accustomed to its presence, and are not opposed to its maintenance.

The cost of constructing the Australian line was nearly £400,000, or about 200*l.* a mile. There every article of material and of food had to be carried in wagons over the whole distance, the furthest to the centre being about 1200 miles in length, through an uninhabited country, destitute of people to aid the expedition, of water, and of all means of sustenance. Besides 5000 tons of wooden poles, which

had to be cut, prepared, and carried an average distance of 8 to 10 miles, the greatest distance having been 350 miles, 2000 tons of materials had to be carried, and several thousand head of cattle and sheep had to be driven into the interior for the supply of the expedition, while tracts of 50 feet wide had to be cut and cleared through many hundred miles of dense forest scrub. Nine stations were substantially erected and equipped on the line.

With regard to the difficulties of transport, the African line appears to be more favoured than the Australian. It is proposed to introduce upon each of the three great lakes a steamer, of sufficient capacity to distribute the materials, from a single main depot on each, to the points nearest to the line of construction, and to convey the materials to these depots from the points on the sea-coast nearest, or most accessible, to them. The steamers will remain on the lakes for other general purposes, which will, it is hoped, contribute largely to the opening up and civilising of this part of Africa. The roads or tracks between the coast and the lakes will follow, or anticipate, the efforts now about to be made in the same direction.

The materials, which will for the greater part be of iron, on account of the ravages of the white ant on wood—the poles being made in sections, and the wire being in portable lengths—can be carried by animals, or transported in bullock or camel wagons, where water carriage is unavailable. Pack-horses, mules, and camels were used on the Euphrates line, and can be employed, with bullocks, in Africa, where the Tsetse fly does not prevail.

Some idea can be formed of the weight of the material required. Sir S. Canning and Mr. Sabine state that it will be about 1 ton for each mile. A bullock wagon will carry about  $1\frac{1}{2}$  ton, or enough for  $1\frac{1}{2}$  mile.

Careful explorations will be necessary before deciding upon the points of approach to the lakes. For instance, it will be necessary to determine whether it will be better to carry materials up the Zambesi and Shire to the south of Lake Nyassa, establishing a portage at the Falls, or to convey them from Quiloa to the north of the Lake. Various considerations besides those connected with economy will doubtless influence the decision in some of these cases.

Upon the above grounds, the Conference entertained the opinion that there are no insuperable obstacles to the construction and maintenance of the line of telegraph brought to their notice. The advantages of it in encouraging and assisting the exploration of the region through which it would be carried,—in facilitating the

operations of missionary and mercantile associations throughout it, and in promoting the objects which the Royal Geographical Society has in view, cannot be exaggerated, independently of the political and social benefits it will confer on the settled countries which it will bring into telegraphic communication with the rest of the world. Mr. Kerry Nicholls, from whose paper on this subject much valuable information has been derived, states that the colony of South Australia netted, during the first year after the line across Australia was in operation, more than a quarter of a million sterling extra on its wheat harvest, through the telegraph enabling sales to be made in foreign markets. The advantage of a telegraph in any form—cable or overland—cannot be disputed; but the latter would benefit the whole of the interior of the continent, while a cable line would contribute but slightly to this result.

The Committee subsequently resolved to insert the foregoing *précis* of the results of the Conference among their own published proceedings, and to forward a copy of it to Her Majesty's Secretary of State for the Colonies, to the Khedive, and to their late colleague, Sir Bartle Frere, the Governor of the Cape Colony, with a request to the latter that he should bring it under the consideration of his Council, and commend it to their attention, if he should concur in the views expressed in it.

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